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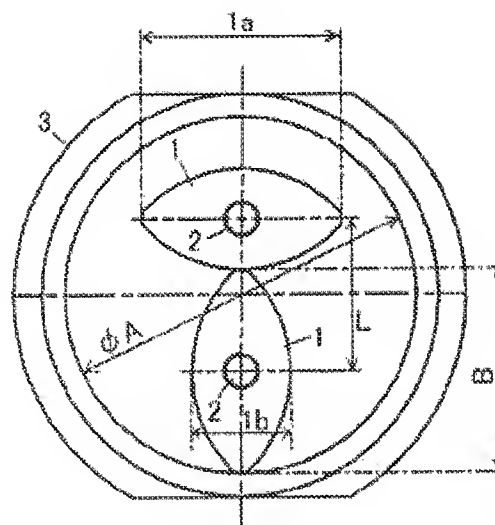
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(54) TWIN-SHAFT STIRRING APPARATUS

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a shape of paired stirring blades, which can certainly prevent the rotation of a stirred fluid together with the rotation of the blades and can certainly prevent a part adhering to the surfaces of the stirring blades not to be stirred from occurring, in a stirring apparatus for a highly viscous fluid with twin-shaft stirring blades.

SOLUTION: In the stirring apparatus, a pair of vertical stirring blades 1 are rotate on their axes in a vertical stirring tank 3 to stir/mix the highly viscous fluid in the stirring tank, the horizontal cross section of the stirring blade 1 is almost an oval shape having its center at a vertical shaft 2 and the sum of the half of a major axis of the oval shape and the half of a minor axis thereof is equal to the distance between the shafts. One stirring blade 1 and the other stirring blade 1 are shifted by 90° in rotary phase and rotated at an equal angular speed in the same direction. The side curved surface shapes of the stirring blades are set so that the leading end part of one stirring blade 1 has a shape almost coming into contact with the side surface part of the other stirring blade 1 at the whole rotary position.



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CLAIMS

[Claim(s)]

[Claim 1]

In an agitating device for which a vertical-axis impeller of a couple is made to rotate within a mixing vessel every length, and high viscous fluid in the above-mentioned mixing vessel is agitated and mixed,

a horizontal section of an impeller centered on a vertical axis -- it is elliptical mostly

One half of the sums of one half and minor-axis length of the major-axis length elliptical [above-mentioned] are equal to a wheel base,

A rotation phase of one impeller and an impeller of another side has shifted 90 degrees, and rotates in the direction at isogonism speed,

An agitating device whose side curved surface shape of an impeller is the form to which a point of one impeller touches a flank part of an impeller of another side mostly in a total rotary place.

[Claim 2]

An agitating device of Claim 1 with which two churning axes revolve around the sun with rotation.

[Claim 3]

An agitating device of Claim 2 longer the elliptical major-axis length of the above-mentioned impeller than one half of wheel bases and almost equal to length inscribed in a vertical mixing vessel on a line which connects between axes.

[Claim 4]

An agitating device of Claim 1 which is a field where the side of the above-mentioned impeller is linear to a lengthwise direction.

[Claim 5]

An agitating device of Claim 1 whose side of the above-mentioned impeller is a screw type-like side.

[Claim 6]

Rotation / revolution drive mechanism of an impeller of the above-mentioned couple makes a carrier of an epicyclic-gear driving mechanism provided with one pair of same planet gears support both impeller axis, enabling free rotation, An agitating device of Claim 2 which drives both impeller axis by the above-mentioned planet gear, respectively, makes a support component support the above-mentioned carrier, enabling free rotation, and coincides a center of rotation of the carrier concerned with the center of a mixing vessel positioned and fixed.

[Claim 7]

An agitating device of Claim 6 with which the above-mentioned epicyclic-gear driving mechanism makes a carrier free, and uses flywheel starter gear or a solar gear as a gear drive.

[Claim 8]

An agitating device of Claim 6 with which the above-mentioned epicyclic-gear driving mechanism uses a carrier as a driving member, and uses flywheel starter gear or a solar gear as a stationary gear.

[Claim 9]

An agitating device of Claim 6 with which a positioning mechanism of a mixing vessel to the above-mentioned impeller provides a non-circular recess in the buck upper surface, carries out fitting of the lower end of an isomorphism-like mixing vessel to the non-circular recess concerned, and fixes a mixing vessel to a buck enabling free attachment and detachment.

[Claim 10]

An agitating device of Claim 5 which means for supporting of the above-mentioned epicyclic-gear driving mechanism make a guide support support an epicyclic-gear driving mechanism, enabling free rise and fall, and is made to carry out a rise-and-fall drive according to a feed screw mechanism.

[Claim 11]

A support component is made to support a gear drive movably, enabling free rotation, and is made to support a churning axis and an intermediate shaft of a couple movably, enabling free rotation. A pinion of a churning axis of a couple and the above-mentioned intermediate shaft is driven by the above-mentioned gear drive,

A rotating table with a gear is provided in a buck, and it is equipped with a mixing vessel at the rotating table concerned, enabling free attachment and detachment,

An agitating device of Claim 5 which drives a gear of a rotating table by a pinion of the above-mentioned intermediate shaft lower end.

[Claim 12]

An agitating device of Claim 11 which made an infinite variable-speed drive placed between the above-mentioned intermediate shafts.

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application]

This invention relates to the agitating device which agitates a fluid with the comparatively high degree of viscosity.

Being able to agitate and mix the fluid of a mixing vessel efficiently uniformly, and rotating an impeller comparatively slowly about the agitating device which agitates the viscous fluid in the mixing vessel on the cylinder of every length by two impellers. Two or more high viscous fluid is with high precision and uniformly mixable in a short time.

[0002]

[Description of the Prior Art]

Not only high viscous fluid but various fluids are put into the cylindrical mixing vessel of every length, and the thing of various mechanisms is among the agitating devices which agitate this by the impeller of a vertical mold. One of them is based on a 1 axis impeller, and the example is indicated to JP,H8-71398,A. Although the form structure of the impeller in such an agitating device is various, what is depended on a spiral thin board, the thing to depend on a plate-like vertical board, etc., Both the things indicated in the above-mentioned gazette shift a phase one by one to a hand of cut, provide in multistage the tabular impeller which has a lengthwise direction churning function and a transverse direction churning function, by this, raise the churning efficiency of a sliding direction and raise the agitation performance of high viscous fluid.

Some which are indicated to JP,2002-113344,A are provided with the 2 axis impeller, for example, and this thing raises agitation efficiency by making it revolve around the sun, making the spiral impeller of two size rotate.

[0003]

Although based on what is depended on a 1 axis impeller, and a 2 axis impeller, about all, each impeller rotates within a mixing vessel independently separately, or it rotates and revolves around the sun, and this is agitated to a hand of cut or a hand of cut, and a lengthwise direction.

Although shearing force acts on the fluid with which the surface rotates to the fluid in a mixing vessel, and is in contact with the wings surface, the impeller in an agitating device, In the case of a fluid (this is called "high viscous fluid" below) with the comparatively high degree of viscosity, it does not exfoliate from the impeller surface for that adhesiveness, but, for that reason, is dragged, this drag power reaches far and wide, and it becomes what a surrounding fluid is taken about for (it corotates). There is also a layer adhering to the impeller surface. For this reason, even if churning / mixing efficiency is very bad as a whole, and the portion hardly agitated and mixed remains, churning / mixing accuracy is bad as a result and it lengthens churning time, it may be unable to agitate and mix uniformly.

[0004]

[Problem(s) to be Solved]

Then, that the portion which is not agitated about the agitating device of the high viscous fluid by a 2 axis impeller by preventing the circumference of the companion of the fluid agitated certainly, and adhering to the impeller surface generates this invention so that it can prevent certainly, Let it be the SUBJECT 1 to devise the form of the impeller of a couple.

[0005]

Let it be the SUBJECT 2 to devise the form of the impeller of a couple so that you may force the fluid in a mixing vessel into the flow in alignment with the fixed course of the turning direction and the lengthwise direction and an equal churning operation may be given to it by the impeller of a couple at the fluid in a mixing vessel.

[0006]

The impeller of a couple makes it the SUBJECT 3 to devise the drive mechanism so that a churning operation may be uniformly exerted on the fluid in a mixing vessel.

[0007]

[Means for Solving the Problem]

[Solving means 1] (It corresponds to Claim 1)

A means (solving means 1) provided in order to solve the aforementioned problem 1 makes a vertical-axis impeller of a couple rotate within a mixing vessel every length, and it is constituted by following (b) thru/or (**) on the assumption that an agitating device which agitates and mixes high viscous fluid in the above-mentioned mixing vessel.

(b) A horizontal section of an impeller centered [that it is elliptical mostly] on a vertical axis,

(**) One half of the sums of one half and minor-axis length of the major-axis length elliptical [above-mentioned] are equal to a wheel base,

(**) A rotation phase of one impeller and an impeller of another side is shifted 90 degrees, and rotates in the direction with constant angular velocity,

(**) Side curved surface shape of an impeller should be the form to which a point of one impeller touches a flank part of an impeller of another side mostly in a total rotary place.

Above "it is elliptical mostly" means what is called elliptical not but form similar to an ellipse which has a major axis and a minor axis.

The above-mentioned "high viscous fluid" means a fluid which has the degree of viscosity which is a grade in which fluid layers which adhered to an impeller and stuck on the surface of an impeller are formed.

[0008]

[Function]

Since the impeller of a couple rotates in the direction after the tip end part of one of these has touched the side of another side mostly, Since the flow (corotation) around which it takes and turns to rotation of one impeller is intercepted by the impeller of another side, it moves to the region of influence of the torque of the impeller of another side, and moves to the region of influence of the torque of the impeller which is one side again after that. Therefore, it is dragged by rotation of one impeller and the turning stream centering on the impeller concerned does not arise. A fluid to be agitated will be agitated in a mixing vessel, repeating the above movements (flow).

[0009]

After the tip end part of the impeller of another side has touched mostly to the side of one impeller, since it rotates to a counter direction mutually, the layer adhering to the side of one impeller fails to be scratched by the impeller of another side, and it is pushed aside to the churning field by the impeller of above-mentioned another side. And dropping [scratch] to each of the both side surfaces of above-mentioned one impeller is repeated at 1 time of a rate for every rotation. Therefore, the fluid which once adhered to the side of the impeller will also be certainly agitated just behind that.

Since one half of the major-axis length of the sectional shape of an impeller and one half of the sums of minor-axis length are almost equal to a wheel base, the center section of a mixing vessel will also be in the churning field by rotation of an impeller.

[0010]

[Embodiment 1] (It corresponds to Claim 2)

The embodiment 1 is making a churning axis revolve around the sun with rotation about the agitating device of the solving means 1.

[0011]

[Function]

Since the tendency around which viscous fluid takes and turns to the whole fluid in a mixing vessel as compared with the case where the equal impeller of each again rotates in the regular position in a churning operation since it revolves around the sun while the impeller of a couple rotates within a mixing vessel is small, an agitating speed improves further.

[0012]

[Embodiment 2] (It corresponds to Claim 3)

The embodiment 2 is the major-axis length elliptical [the] is longer than one half of wheel bases, and almost equal to the length inscribed in a vertical mixing vessel on the line which connects between axes about the impeller of the above-mentioned embodiment 1.

[0013]

[Function]

Since the fluid which adhered also about the inner surface of the mixing vessel since the impeller touched the inner surface of the mixing vessel repeatedly by the rotation, revolving around the sun fails to be scratched at the tip of an impeller and returned to the churning field by an impeller, the fluid which once adhered to the inner surface of the mixing vessel will also be agitated certainly. Therefore, all the portions of a mixing vessel become a churning field by rotation and revolution of an impeller, and are agitated uniformly.

[0014]

[Embodiment 3] (It corresponds to Claim 4)

The embodiment 3 is having made the side of the impeller in the above-mentioned solving means 1 into the field linear to a lengthwise direction.

[0015]

[Function]

Since the side of an impeller is a field linear to a lengthwise direction, it is agitated, while viscous fluid is pushed ahead [hand-of-cut] and extruded over a surface area by the method of the outside of a radial direction by rotation of an impeller. At this time, where line contact is mostly carried out along the straight line of a lengthwise direction to the side of the impeller of another side, it will slide on a hand of cut, and the point of one impeller will turn the viscous fluid adhering to the side of the impeller of above-mentioned another side ahead [hand-of-cut], and will rake it out. Since the side of an impeller is a field linear to a lengthwise direction, the form is comparatively simple, therefore manufacture is comparatively easy.

[0016]

[Solving means 2] (It corresponds to Claim 5)

The means (solving means 2) provided in order to solve the aforementioned problem 2 is that the side of the impeller in the above-mentioned solving means 1 is a screw type-like side.

[0017]

[Function]

Since the side of an impeller is a screw type-like side, it is agitated, while an impeller functions as a screw and it viscous fluid is not only stirred by rotation of an impeller, but is extruded by the method of the outside of a radial direction, and the slanting lower part (it is the slanting upper part depending on a hand of cut) over a surface area. Thus, since it is positively agitated by the sliding

direction while viscous fluid is stirred, in a mixing vessel, a complicated flow is produced and churning is promoted by this.

The point of one impeller is a screw type-like, is in the state which carried out line contact mostly along with the spiral of a lengthwise direction to the spiral side of the impeller of another side, will slide on a spiral direction, and the viscous fluid adhering to the side of the impeller of above-mentioned another side will be turned to the hand-of-cut front and a slanting lower part, and it will rake it out.

[0018]

Although the screw type spiral pitch of the above is arbitrary, the operation which extrudes a fluid caudad increases, so that a spiral pitch is small, and another side resistance also increases. On the other hand, the extrusion rate to a lower part falls, so that a spiral pitch is small. Since the relation between this pitch and the agitation performance of an impeller is based also on physical properties, such as revolving speed of an impeller, and the degree of viscosity of the fluid agitated, an optimum pitch is not generally decided. There is no other way but separately optimal to spiral choose [a required churning degree, churning time, etc.].

[0019]

[Solving means 3] (It corresponds to Claim 6)

The means (solving means 3) provided in order to solve the aforementioned problem 3 is having constituted the drive mechanism which makes the impeller of the couple rotate and revolve around the sun by following (b) (**) and (**) about the embodiment 1 of the above-mentioned solving means 1.

(b) The carrier of the epicyclic-gear driving mechanism provided with the same planet gear of a couple was made to support both the impeller axis, enabling free rotation,

(**) Drive both impeller axis by the above-mentioned planet gear, respectively,

(**) A support component was made to support the above-mentioned carrier, enabling free rotation, and a center of rotation of the carrier concerned was coincided with the center of a mixing vessel positioned and fixed.

[0020]

[Function]

Since the center of rotation of the carrier of an epicyclic-gear driving mechanism is in agreement with the center of a mixing vessel, while two impellers serve as a pair and rotate at uniform velocity in the direction, along with the concentric circle to a mixing vessel, it revolves around the sun. Therefore, the fluid in a mixing vessel is uniformly agitated uniformly [the churning operation by the impeller of a couple] in the fluid in a mixing vessel.

[0021]

[Embodiment 1] (It corresponds to Claim 7)

The embodiment 1 is having made the carrier free and having used flywheel starter gear or a solar gear as the gear drive about the epicyclic-gear driving mechanism of the above-mentioned solving means 3.

[0022]

[Embodiment 2] (It corresponds to Claim 8)

The embodiment 2 is having used the carrier as the driving member and having used flywheel starter gear or a solar gear as the stationary gear about the epicyclic-gear driving mechanism of the above-mentioned solving means 3.

[0023]

[Embodiment 3] (It corresponds to Claim 9)

The embodiment 3 is having provided the non-circular recess in the buck upper surface, having carried out fitting of the lower end of an isomorphism-like mixing vessel to the non-circular recess concerned, and having fixed the mixing vessel to the above-mentioned buck about the positioning mechanism of the mixing vessel to the impeller in the above-mentioned solving means 3, enabling

free attachment and detachment.

[0024]

[Function]

By fixing the means for supporting and the above-mentioned buck of an epicyclic-gear gearing, where the center of rotation of an epicyclic-gear gearing and the center of the non-circular recess on the upper surface of a buck are coincided. Since the center of the non-circular recess on the upper surface of a buck and the center of rotation of an epicyclic-gear gearing are in agreement, the center of rotation of an epicyclic-gear gearing and the center of a mixing vessel are always in agreement by carrying out fitting of the lower end of an isomorphism-like mixing vessel to the non-circular recess on the upper surface of a buck.

Therefore, attachment of the mixing vessel at the time of a maintenance can be made simply and easy.

[0025]

[Embodiment 4] (It corresponds to Claim 10)

The embodiment 4 is making an epicyclic-gear driving mechanism support by a guide support, enabling free rise and fall, and having been made to carry out a rise-and-fall drive according to a feed screw mechanism about the means for supporting of the epicyclic-gear driving mechanism in the above-mentioned embodiment 3.

[0026]

[Function]

By raising the above-mentioned base material by the above-mentioned feed screw mechanism, by being able to pull up an impeller with an epicyclic-gear driving mechanism, and being able to take out from a mixing vessel to the upper part, and making it descend, an impeller can be depressed and it can insert in a mixing vessel from the upper part with an epicyclic-gear driving mechanism. Since between the detaching operation to the mixing vessel of this impeller is maintained by a guide support, as for the physical relationship of an impeller and a mixing vessel, it does not need to perform positioning of an impeller and a mixing vessel at the time of re mounting.

[0027]

[Solving means 4] (It corresponds to Claim 11)

Other means (solving means 4) provided in order to solve the aforementioned problem 3 are having constituted the drive mechanism of the agitating device by the above-mentioned solving means 2 by following (b) thru/or (**).

(b) The support component was made to support a gear drive movably, enabling free rotation, and was made to support the churning axis and intermediate shaft of a couple movably, enabling free rotation,

(**) Provide a rotating table with the gear in a (**) buck, and equip [driving the pinion of the churning axis of a couple, and the above-mentioned intermediate shaft by the above-mentioned gear drive,] it with a mixing vessel at the rotating table concerned, enabling free attachment and detachment,

(**) Drive the gear of a rotating table by the pinion of the above-mentioned intermediate shaft lower end.

[0028]

[Function]

The churning axis of a couple is driven at uniform velocity in the direction by the above-mentioned gear drive. On the other hand, since a rotating table is driven by the above-mentioned gear drive via an intermediate shaft, it is driven to a counter direction with a churning axis. Therefore, a mixing vessel drives to a counter direction with an impeller.

And since the viscous fluid in it circles to a counter direction with an impeller by rotation of a mixing vessel, a stirring effect and an agitating speed improve notably uniformly [the stirring effect by an impeller] to the viscous fluid in a mixing vessel.

[0029]

[Embodiment 1] (It corresponds to Claim 12)

The embodiment 1 is having made the infinite variable-speed drive placed between the above-mentioned intermediate shafts about the drive mechanism of the solving means 4.

[0030]

[Function]

Since the above-mentioned rotating table drives by the above-mentioned gear drive via the infinite variable-speed drive of an intermediate shaft, the revolving speed of a rotating table is stepless and is adjusted.

Since a churning operation of the agitating device by the solving means 4 is adjusted with the rotating velocity of an impeller, and the revolving speed of a mixing vessel, it can adjust a churning operation suitably according to the kind of fluid to be agitated, the churning purpose, churning lapsed time, etc. by adjusting the revolving speed of a rotating table with an infinite variable-speed drive. Since the hand of cut of a rotating table is reversed and the revolving speed can be adjusted if it is made the gearbox which can reverse the above-mentioned infinite variable-speed drive, it is still wide range and the strength of a churning operation can be adjusted with the roll control of a rotating table.

[0031]

[Embodiment of the Invention]

[Work example 1]

Sag of the two axes 2 and 2 is carried out by the wheel base L from the epicyclic-gear gearing, and the impeller 1 is attached to the axes 2 and 2 of this couple, respectively. These impellers 1 and 1 are fields where that side is linear to a lengthwise direction.

It is mutually turned in the right-angled direction, and the axes 2 and 2 rotate in the direction at uniform velocity.

The major axis 1a of the impeller 1 of this example is 71 mm, and the minor axis 1b is 35 mm. And although the curved surface shape of the side of an impeller can be chosen suitably, when both the impellers 1 and 1 rotate, in a total rotary place, the major-axis end of one impeller has a relation which touches the side of the impeller of another side mostly.

[0032]

Namely, when it is as an example of the form of the impeller 1 and the plane shape of the two impellers 1 and 1 being shown in drawing 14 (a) and two impellers in this thing have a right-angled relation mutually, When distance between the axes of rotation of two impellers is set to L, the curvature radius of the impeller side curved surface is set to R and the major-axis end circle radius of an impeller is set to alpha, It is $L=R+\alpha$, $R=L-\alpha$, and $\alpha=L-R$, and when distance of the center of the curvature radius R of the impeller side curved surface and an impeller shaft center is set to C, it can compute by $C=\sqrt{L/2-\alpha}$. If the inside diameter of the mixing vessel at this time is set to D, it will be set to $D=2(C+\alpha)+L$, and that center will serve as the middle point between the two axes of rotation.

Drawing 14 (b) sets the wheel base L to 50, is an example when the major-axis end circle radius alpha is set to 3, and is set to $R=50-3=47$, $C=\sqrt{50/2-3}=31.113$, and $D=2(31.113+3)+50=118.226$.

Drawing 14 (c) sets the wheel base L to 50, shows plane shape in case the major-axis end which set the major-axis end circle radius alpha to 0 is edge shape, and is set to $R=50-0=50$ in this case, $C=\sqrt{50/2-0}=35.355$, and $D=2(35.355+0)+50=120.71$.

[0033]

Although the viscous fluid in the mixing vessel 3 is agitated by the impellers 1 and 1 of the above-mentioned couple, the inside diameter A of the mixing vessel 2 in this example is 124 mm, and the depth is 55 mm.

Relative rotating of the impeller of a couple is carried out in the direction in the mode of drawing 3 (a), (b), and (c). It slides so that the above-mentioned side may be ground, after the tip end part of one impeller 1 contacted mostly and has contacted in the lengthwise direction straight line to the side of the impeller 1 of another side at this time. Therefore, the flow of viscous fluid around which it takes and turns to the arrow direction of drawing 3 with one impeller will be severed by the impeller of another side, and will be pushed back in the direction contrary to the flow. The viscous fluid adhering to the flank part of the impeller of another side fails to be scratched by the point of one impeller. And the side which it fails to scratch of the two impellers so that change of drawing 3 (a), (b), and (c) may show, Since the side in which the side which fails to be scratched takes the place one by one by rotation, and one impeller fails to be scratched is also changed one by one by rotation of an impeller, the viscous fluid adhering to the both side surfaces of two impellers will fail to be scratched intermittently.

Since the major-axis end of the impeller 1 of this example slides on the inner surface of the mixing vessel 3 intermittently and the impellers 1 and 1 revolve around the sun within a mixing vessel, the viscous fluid adhering to the inner surface of the mixing vessel also fails to be intermittently scratched by the tip of an impeller.

[0034]

Only 50 cc (viscous degree 80 Pa-s), feed 100 cc (viscous degree 100 Pa-s) and the ink for lithography (yellow) into the mixing vessel 3, and the ink for lithography (cyanogen) under 25 ** temperature, By 76 rotating velocity/of an impeller, when [20 revolution speed] agitating by a part for /, as compared with the case (the conditions) where it is based on the conventional agitating device, the churning time is mostly shortened to 1/10.

Although churning unevenness is not avoided in conventional technology, churning unevenness is completely solved in this example.

[0035]

Next, the rising and falling mechanism of the impeller drive by the epicyclic-gear gearing of this embodiment and an agitating device, etc. are explained.

Impeller drives are epicyclic-gear dynamo-electric means of the form which the flywheel starter gear 4 are being fixed to the support plate 14, and the carrier of a planet gear drives with an electric motor.

The support plate 14 is guided by the two guide supports 21 and 21, enabling free rise and fall. The vertical screw-thread axis 23 is among the guide supports 21 and 21, the lower end is supported by the buck 20 by a bearing, enabling free rotation, and the upper part is supported by the bearing by the side between the guide supports 21 and 21, enabling free rotation. And **** on the screw-thread axis 23, the sleeve 22 is made to have screwed, and this screw-thread sleeve 22 is being fixed to the support plate 14.

The flywheel starter gear 4 are being fixed to the undersurface of the support plate 14 with the screw 14a, and an upper bed of the cylindrical carrier 9 is supported by these flywheel starter gear 4 via the bearing 10.

The carrier 9 is held via the bearing 10 at the flywheel starter gear 4, enabling free rotation.

The two vertical axes 2 and 2 are supported by this carrier 9 via the bearings 8 and 8, enabling free rotation.

The driving shaft 15 was inserted in a center hole of the carrier 9, it has adhered, and the upper bed is connected with an axis of the electric motor 18 via the coupling 17, enabling free attachment and detachment.

[0036]

The planet gears 5 and 5 have adhered to an upper bed of the vertical axes 2 and 2, respectively, and these planet gears 5 and 5 have geared to the above-mentioned flywheel starter gear 4. The vertical axes 2 and 2 are caudad prolonged from a lower end of the carrier 9, and the lower end is

inserted in a center hole of the above-mentioned impellers 1 and 1. In this example, the impeller electrode holder 7 has adhered to an upper bed side of the impeller 1, and this impeller electrode holder 7 has adhered to the vertical axes 2 and 2 by a pin, enabling free attachment and detachment.

As mentioned above, since the vertical axes 2 and 2 are held via the bearings 8 and 8 at the carrier 9, the carrier 9 is held via the bearing 10 at the flywheel starter gear 4, the flywheel starter gear 4 **** and it is being fixed to the support plate 14 by 14a, If the screw-thread axis 23 is rotated by the handle 24 and you make it go up and down the support plate 14, a drive will go up and down with this, and an impeller will go up and down. By raising an impeller, when the impeller 1 escapes to the upper part and drops it from the mixing vessel 3, the impeller 1 is inserted into the mixing vessel 3. [0037]

The mixing vessel 3 is a cylindrical body, that lower end has the flange 3a, and the flat-surface part 3b of the couple which opposes this flange 3a is formed. On the other hand, the upper surface of the buck 20 has a crevice of form into which the flange 3a of the mixing vessel 3 gets densely, the above-mentioned flange will get into this crevice, and the mixing vessel 3 will be held at the buck 20 at rotation impossible.

[0038]

The driving shaft 15 drives via the coupling 17 with the axis of an electric motor, the carrier 9 drives by this, and the revolution drive of the vertical axes 2 and 2 is carried out by rotation of the carrier 9. Since the planet gear which has adhered to the upper bed of the vertical axes 2 and 2 has geared to the flywheel starter gear 4, while the vertical axes 2 and 2 rotate, it will revolve around the sun. And the two above-mentioned planet gears are the same, and since it has geared to the same flywheel starter gear 4, the revolving speed of both the vertical axes 2 and 2 is equal, and revolves the same orbit top around the sun.

[0039]

[Work example 2]

Subsequently, the example of the agitating device by the solving means 2 is explained. This Embodiment 2 does not have a difference in particular with the above-mentioned Embodiment 1 except for the point that the side of an impeller is a screw type-like side. The upper bed side of the impeller of this thing is in the position which shifted to the hand of cut 90 degrees to the lower end surface, and the side in the meantime and end rim are a screw type.

The plane shape of this thing and side form are as being shown in drawing 9 (a) and (b), and the section A-A in drawing 9 (b), B-B, C-C, D-D, and E-E are as being shown in drawing 10 (A) - (E), respectively.

All of such sectional shape are the same.

The elliptical (not the thing that says a strict ellipse but form which resembled the ellipse mostly) outline of the end face of the impeller 31 of this example, It is the form drawn by major axis of 71 mm, and 35 mm of minor axes with the common inscribed circle arc z and the partial circle of the above-mentioned imaginary circle x to the imaginary circle x with a radius of 4.77 mm of major-axis both ends, and the imaginary circle y with a main radius of 17.5 mm. The height of this impeller 31 is 50 mm. The overview of this thing is as being shown in drawing 11.

[0040]

By the same appearance as the case where two screws (screw-thread stick) gear mutually, the two impellers 31 and 31 are put together mutually, are arranged, and rotate at uniform velocity in the direction like Embodiment 1. A fluid is agitated at this time, the impeller 31 spiral-like side extruding at the method of the outside of a radial direction, and a slanting lower part (or slanting upper part). And since it exercises for a counter direction mutually while a major axis direction end spiral to one impeller slides on the spiral side of the impeller of another side mutually in the state where it contacted mostly, it is failed to scratch the viscous fluid adhering to the spiral side of the impeller of

above-mentioned another side at the major axis direction end of above-mentioned one impeller. Since the impeller 31 extrudes in a direction with the velocity component of a turning direction, and the velocity component of the lengthwise direction strongly and a complicated flow is generated between the mixing vessel 3 and the impellers 31 and 31, the viscous fluid in the mixing vessel 3 has a very high stirring effect. Therefore, what is called a Weissenberg effect generated when the degree of viscosity mixes a greatly different substance (a unique flow phenomenon: if a stick is thrust in and stirred in a solution, an oil level will be cratered in a Newton liquid, but.) In a non-Newtonian liquid, the phenomenon which goes up by carrying out can be controlled so that it may rise conversely and may coil around a stick, and even when the degree of viscosity mixes a greatly different substance, churning and mixing are made very efficiently.

[0041]

As for the impellers 31 and 31 of the agitating device shown in drawing 7 and drawing 8, it is needless to say that it drives with the drive by the epicyclic-gear driving mechanism shown in drawing 4 thru/or drawing 6, both impellers are made to rotate and revolve around the sun, and the viscous fluid in the mixing vessel 3 can be agitated. However, as for the screw type-like two impellers 31 and 31, since the churning operation is powerful, a stirring effect is enough demonstrated only by rotation. Therefore, viscous fluid can fully be agitated only by rotation of the impellers 31 and 31 in a short time.

A churning drive only by rotation of the impellers 31 and 31 is shown in drawing 12. This thing is supported by the support plate 42 currently supported by the guide supports 41 and 41 enabling free rise and fall, enabling free rotation of the gear drive 43.

A vertical axis of the impellers 31 and 31 is supported enabling free rotation.

The pinion 44 has adhered to this vertical axis, respectively, and the pinion concerned has geared with the gear drive 43.

Since the pinion 44 will drive at uniform velocity in the direction if the driving shaft 45 of the gear drive 43 is driven with an electric motor, the impellers 31 and 31 drive at uniform velocity in the direction.

[0042]

An example of other drives is explained with reference to drawing 13. This drive also drives the mixing vessel 3 simultaneously with an impeller to an example of drawing 12 driving the impellers 31 and 31. In the pinion 44, an opposite hand is made to have supported the intermediate shaft 51, enabling free rotation to the support plate 42, and the pinion 52 which adhered to an upper bed of this intermediate shaft is engaged to the gear drive 43. On the other hand, the buck 60 is made to have supported the rotating table 61, enabling free rotation, and this rotating table 61 is made to attach the mixing vessel 3 like Embodiment 1, enabling free attachment and detachment. And the gear 61a is formed in a peripheral face of the rotating table 61, and the pinion 53 which adhered to the gear 61a concerned in a lower end of the intermediate shaft 51 has geared.

Therefore, the rotating table 61 drives to the impeller 3 and a counter direction via the intermediate shaft 51 and the pinions 52 and 53 by the gear drive 43, therefore the mixing vessel 3 drives to the impeller 3 and a counter direction.

[0043]

Since high viscous fluid corotates to an arrow direction and the impeller 31 rotates to a counter direction with this by rotation of the mixing vessel 3, a stirring effect improves further. Since a stirring effect changes by adjusting revolving speed of an impeller, and revolving speed of the mixing vessel 3, A stirring effect can be minutely adjusted to the intermediate shaft 51 according to character of a fluid in the mixing vessel 3, and the churning purpose by making an easy infinite variable-speed drive by friction roller, a V belt, etc. intervene, and adjusting revolving speed of the mixing vessel 3 by this.

[0044]

[Effect of the Invention]

It will be as follows if this effect of the invention is arranged.

1. The 1st effect of the invention

Invention (invention concerning Claim 1) by the solving means 1, By the impeller of a couple rotating in the direction, and rotating, rubbing each other, after the major-axis end of one impeller has contacted the side of the impeller of another side mostly, The flow of the fluid which takes and corotates to rotation of each impeller is intercepted by the impeller of another side, corotation is prevented, and it pushes back in the direction with the opposite corotation direction concerned. Thus, the pushed-back fluid moves to the churning field of the impeller of above-mentioned another side, and is agitated by this. It is failed at the major-axis end of above-mentioned one impeller to scratch the layer of the fluid adhering to the side of the impeller of above-mentioned another side, is derived to the churning field of one impeller, and is agitated by this. Therefore, the fluid in a mixing vessel is agitated uniformly.

[0045]

2. The 2nd effect of the invention

Invention (invention concerning Claim 5) by the solving means 2, By the side of an impeller being a spiral surface and the impeller of a couple rotating in the direction, and rotating, rubbing each other, after the major-axis end of one impeller has contacted the side of the impeller of another side mostly, The flow of the fluid which takes and corotates to rotation of each impeller is intercepted by the impeller of another side, corotation is prevented, and it pushes back in the direction with the opposite corotation direction concerned.

Since horizontal section form is elliptical mostly and the side is a spiral form, since the rotation extrudes in the lower part (it is the upper part depending on a hand of cut) of a fluid strongly, the strong flow of a sliding direction is produced in viscous fluid by it.

Since viscous fluid flows in a complicated course by churning accompanying rotation, and churning by the flow of a sliding direction, changing a direction, churning is promoted further.

[0046]

3. The 3rd effect of the invention

Since invention (invention concerning Claim 6) by the solving means 3 drives the churning impeller of a couple with an epicyclic-gear gear and makes this rotate and revolve around the sun, it can rotate the impeller of a couple at uniform velocity with easy drive mechanism, and can be made to revolve around the sun on the orbit. Therefore, the manufacturing cost of drive mechanism can be reduced and the small weight saving of a drive is attained.

[0047]

4. The 4th effect of the invention

Invention (invention concerning Claim 11) by the solving means 4, Since a mixing vessel is rotated while making an impeller rotate, it compares with what produces a stirring effect only in rotation of an impeller, Although a stirring effect is remarkably high, and the rotary drive of a mixing vessel is made into rotation and the thing of form made to revolve around the sun since it is very simple, and agitation performance is not exceptionally different, a drive can be simplified remarkable.

Agitation performance can be suitably adjusted by adjusting the revolving speed of a mixing vessel, with the revolving speed of an impeller fixed.

[Brief Description of the Drawings]

[Drawing 1] The top view of the important section of ***** 1.

[Drawing 2] The perspective view of the important section of ***** 1.

[Drawing 3] The top view showing the operating state of ***** 1.

[Drawing 4] The important section top view of the impeller drive of ***** 1.

[Drawing 5] Drawing of longitudinal section of ***** 1.

[Drawing 6] Drawing of longitudinal section of the important section of the impeller drive of ***** 1.

[Drawing 7] The top view of the important section of ***** 2.

[Drawing 8]The perspective view of the important section of ***** 2.

[Drawing 9](a) is a top view of the impeller of Embodiment 2, and (b) is a side view of the impeller.

[Drawing 10](A) – (E) is a section A-A in Fig. 9 (b) – a sectional view of E-E.

[Drawing 11]The whole impeller outline view of ***** 2.

[Drawing 12]The perspective view of Embodiment 2 showing an example of a ***** drive.

[Drawing 13]The perspective view of Embodiment 2 showing other examples of *****.

[Drawing 14](a) and (b) are the top views for explaining an example of the plane shape of the impeller in an embodiment.

(b) is a top view for explaining other examples of plane shape, and (c) is a top view for explaining the example of further others.

[Explanations of letters or numerals]

1: Impeller

2: Vertical axis

3: Mixing vessel

4: Flywheel starter gear

5: Planet gear

7: Impeller electrode holder

8: Bearing

9: Carrier

10: Bearing

14: Support plate

15: Driving shaft

17: Coupling

20: Buck

21: Guide support

23: Screw-thread axis

31: Impeller

41: Guide support

42: Support plate

43: Gear drive

44: Pinion

45: Driving shaft

51: Intermediate shaft

52, 53: Pinion

60: Buck

61: Rotating table

61a: Gear

[Translation done.]

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TECHNICAL FIELD

[Industrial Application]

This invention relates to the agitating device which agitates a fluid with the comparatively high degree of viscosity.

Being able to agitate and mix the fluid of a mixing vessel efficiently uniformly, and rotating an impeller comparatively slowly about the agitating device which agitates the viscous fluid in the mixing vessel on the cylinder of every length by two impellers. Two or more high viscous fluid is with high precision and uniformly mixable in a short time.

[0002]

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PRIOR ART

[Description of the Prior Art]

Not only high viscous fluid but various fluids are put into the cylindrical mixing vessel of every length, and the thing of various mechanisms is among the agitating devices which agitate this by the impeller of a vertical mold. One of them is based on a 1 axis impeller, and the example is indicated to JP,H8-71398,A. Although the form structure of the impeller in such an agitating device is various, what is depended on a spiral thin board, the thing to depend on a plate-like vertical board, etc., Both the things indicated in the above-mentioned gazette shift a phase one by one to a hand of cut, provide in multistage the tabular impeller which has a lengthwise direction churning function and a transverse direction churning function, by this, raise the churning efficiency of a sliding direction and raise the agitation performance of high viscous fluid.

Some which are indicated to JP,2002-113344,A are provided with the 2 axis impeller, for example, and this thing raises agitation efficiency by making it revolve around the sun, making the spiral impeller of two size rotate.

[0003]

Although based on what is depended on a 1 axis impeller, and a 2 axis impeller, about all, each impeller rotates within a mixing vessel independently separately, or it rotates and revolves around the sun, and this is agitated to a hand of cut or a hand of cut, and a lengthwise direction.

Although shearing force acts on the fluid with which the surface rotates to the fluid in a mixing vessel, and is in contact with the wings surface, the impeller in an agitating device, In the case of a fluid (this is called "high viscous fluid" below) with the comparatively high degree of viscosity, it does not exfoliate from the impeller surface for that adhesiveness, but, for that reason, is dragged, this drag power reaches far and wide, and it becomes what a surrounding fluid is taken about for (it corotates). There is also a layer adhering to the impeller surface. For this reason, even if churning / mixing efficiency is very bad as a whole, and the portion hardly agitated and mixed remains, churning / mixing accuracy is bad as a result and it lengthens churning time, it may be unable to agitate and mix uniformly.

[0004]

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EFFECT OF THE INVENTION

[Effect of the Invention]

It will be as follows if this effect of the invention is arranged.

1. The 1st effect of the invention

Invention (invention concerning Claim 1) by the solving means 1, By the impeller of a couple rotating in the direction, and rotating, rubbing each other, after the major-axis end of one impeller has contacted the side of the impeller of another side mostly, The flow of the fluid which takes and corotates to rotation of each impeller is intercepted by the impeller of another side, corotation is prevented, and it pushes back in the direction with the opposite corotation direction concerned. Thus, the pushed-back fluid moves to the churning field of the impeller of above-mentioned another side, and is agitated by this. It is failed at the major-axis end of above-mentioned one impeller to scratch the layer of the fluid adhering to the side of the impeller of above-mentioned another side, is derived to the churning field of one impeller, and is agitated by this. Therefore, the fluid in a mixing vessel is agitated uniformly.

[0045]

2. The 2nd effect of the invention

Invention (invention concerning Claim 5) by the solving means 2, By the side of an impeller being a spiral surface and the impeller of a couple rotating in the direction, and rotating, rubbing each other, after the major-axis end of one impeller has contacted the side of the impeller of another side mostly, The flow of the fluid which takes and corotates to rotation of each impeller is intercepted by the impeller of another side, corotation is prevented, and it pushes back in the direction with the opposite corotation direction concerned.

Since horizontal section form is elliptical mostly and the side is a spiral form, since the rotation extrudes in the lower part (it is the upper part depending on a hand of cut) of a fluid strongly, the strong flow of a sliding direction is produced in viscous fluid by it.

Since viscous fluid flows in a complicated course by churning accompanying rotation, and churning by the flow of a sliding direction, changing a direction, churning is promoted further.

[0046]

3. The 3rd effect of the invention

Since invention (invention concerning Claim 6) by the solving means 3 drives the churning impeller of a couple with an epicyclic-gear gear and makes this rotate and revolve around the sun, it can rotate the impeller of a couple at uniform velocity with easy drive mechanism, and can be made to revolve around the sun on the orbit. Therefore, the manufacturing cost of drive mechanism can be reduced and the small weight saving of a drive is attained.

[0047]

4. The 4th effect of the invention

Invention (invention concerning Claim 11) by the solving means 4, Since a mixing vessel is rotated while making an impeller rotate, it compares with what produces a stirring effect only in rotation of

an impeller, Although a stirring effect is remarkably high, and the rotary drive of a mixing vessel is made into rotation and the thing of form made to revolve around the sun since it is very simple, and agitation performance is not exceptionally different, a drive can be simplified remarkable. Agitation performance can be suitably adjusted by adjusting the revolving speed of a mixing vessel, with the revolving speed of an impeller fixed.

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TECHNICAL PROBLEM

[Problem(s) to be Solved]

Then, that the portion which is not agitated about the agitating device of the high viscous fluid by a 2 axis impeller by preventing the circumference of the companion of the fluid agitated certainly, and adhering to the impeller surface generates this invention so that it can prevent certainly, Let it be the SUBJECT 1 to devise the form of the impeller of a couple.

[0005]

Let it be the SUBJECT 2 to devise the form of the impeller of a couple so that you may force the fluid in a mixing vessel into the flow in alignment with the fixed course of the turning direction and the lengthwise direction and an equal churning operation may be given to it by the impeller of a couple at the fluid in a mixing vessel.

[0006]

The impeller of a couple makes it the SUBJECT 3 to devise the drive mechanism so that a churning operation may be uniformly exerted on the fluid in a mixing vessel.

[0007]

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MEANS

[Means for Solving the Problem]

[Solving means 1] (It corresponds to Claim 1)

A means (solving means 1) provided in order to solve the aforementioned problem 1 makes a vertical-axis impeller of a couple rotate within a mixing vessel every length, and it is constituted by following (b) thru/or (**) on the assumption that an agitating device which agitates and mixes high viscous fluid in the above-mentioned mixing vessel.

(b) A horizontal section of an impeller centered [that it is elliptical mostly] on a vertical axis,

(**) One half of the sums of one half and minor-axis length of the major-axis length elliptical [above-mentioned] are equal to a wheel base,

(**) A rotation phase of one impeller and an impeller of another side is shifted 90 degrees, and rotates in the direction with constant angular velocity,

(**) Side curved surface shape of an impeller should be the form to which a point of one impeller touches a flank part of an impeller of another side mostly in a total rotary place.

Above "it is elliptical mostly" means what is called elliptical not but form similar to an ellipse which has a major axis and a minor axis.

The above-mentioned "high viscous fluid" means a fluid which has the degree of viscosity which is a grade in which fluid layers which adhered to an impeller and stuck on the surface of an impeller are formed.

[0008]

[Translation done.]

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OPERATION

[Function]

Since the impeller of a couple rotates in the direction after the tip end part of one of these has touched the side of another side mostly, Since the flow (corotation) around which it takes and turns to rotation of one impeller is intercepted by the impeller of another side, it moves to the region of influence of the torque of the impeller of another side, and moves to the region of influence of the torque of the impeller which is one side again after that. Therefore, it is dragged by rotation of one impeller and the turning stream centering on the impeller concerned does not arise. A fluid to be agitated will be agitated in a mixing vessel, repeating the above movements (flow).

[0009]

After the tip end part of the impeller of another side has touched mostly to the side of one impeller, since it rotates to a counter direction mutually, the layer adhering to the side of one impeller fails to be scratched by the impeller of another side, and it is pushed aside to the churning field by the impeller of above-mentioned another side. And dropping [scratch] to each of the both side surfaces of above-mentioned one impeller is repeated at 1 time of a rate for every rotation. Therefore, the fluid which once adhered to the side of the impeller will also be certainly agitated just behind that.

Since one half of the major-axis length of the sectional shape of an impeller and one half of the sums of minor-axis length are almost equal to a wheel base, the center section of a mixing vessel will also be in the churning field by rotation of an impeller.

[0010]

[Embodiment 1] (It corresponds to Claim 2)

The embodiment 1 is making a churning axis revolve around the sun with rotation about the agitating device of the solving means 1.

[0011]

[Function]

Since the tendency around which viscous fluid takes and turns to the whole fluid in a mixing vessel as compared with the case where the equal impeller of each again rotates in the regular position in a churning operation since it revolves around the sun while the impeller of a couple rotates within a mixing vessel is small, an agitating speed improves further.

[0012]

[Embodiment 2] (It corresponds to Claim 3)

The embodiment 2 is the major-axis length elliptical [the] is longer than one half of wheel bases, and almost equal to the length inscribed in a vertical mixing vessel on the line which connects between axes about the impeller of the above-mentioned embodiment 1.

[0013]

[Function]

Since the fluid which adhered also about the inner surface of the mixing vessel since the impeller

touched the inner surface of the mixing vessel repeatedly by the rotation, revolving around the sun fails to be scratched at the tip of an impeller and returned to the churning field by an impeller, the fluid which once adhered to the inner surface of the mixing vessel will also be agitated certainly. Therefore, all the portions of a mixing vessel become a churning field by rotation and revolution of an impeller, and are agitated uniformly.

[0014]

[Embodiment 3] (It corresponds to Claim 4)

The embodiment 3 is having made the side of the impeller in the above-mentioned solving means 1 into the field linear to a lengthwise direction.

[0015]

[Function]

Since the side of an impeller is a field linear to a lengthwise direction, it is agitated, while viscous fluid is pushed ahead [hand-of-cut] and extruded over a surface area by the method of the outside of a radial direction by rotation of an impeller. At this time, where line contact is mostly carried out along the straight line of a lengthwise direction to the side of the impeller of another side, it will slide on a hand of cut, and the point of one impeller will turn the viscous fluid adhering to the side of the impeller of above-mentioned another side ahead [hand-of-cut], and will rake it out. Since the side of an impeller is a field linear to a lengthwise direction, the form is comparatively simple, therefore manufacture is comparatively easy.

[0016]

[Solving means 2] (It corresponds to Claim 5)

The means (solving means 2) provided in order to solve the aforementioned problem 2 is that the side of the impeller in the above-mentioned solving means 1 is a screw type-like side.

[0017]

[Function]

Since the side of an impeller is a screw type-like side, it is agitated, while an impeller functions as a screw and it viscous fluid is not only stirred by rotation of an impeller, but is extruded by the method of the outside of a radial direction, and the slanting lower part (it is the slanting upper part depending on a hand of cut) over a surface area. Thus, since it is positively agitated by the sliding direction while viscous fluid is stirred, in a mixing vessel, a complicated flow is produced and churning is promoted by this.

The point of one impeller is a screw type-like, is in the state which carried out line contact mostly along with the spiral of a lengthwise direction to the spiral side of the impeller of another side, will slide on a spiral direction, and the viscous fluid adhering to the side of the impeller of above-mentioned another side will be turned to the hand-of-cut front and a slanting lower part, and it will rake it out.

[0018]

Although the screw type spiral pitch of the above is arbitrary, the operation which extrudes a fluid caudad increases, so that a spiral pitch is small, and another side resistance also increases. On the other hand, the extrusion rate to a lower part falls, so that a spiral pitch is small. Since the relation between this pitch and the agitation performance of an impeller is based also on physical properties, such as revolving speed of an impeller, and the degree of viscosity of the fluid agitated, an optimum pitch is not generally decided. There is no other way but separately optimal to spiral choose [a required churning degree, churning time, etc.].

[0019]

[Solving means 3] (It corresponds to Claim 6)

The means (solving means 3) provided in order to solve the aforementioned problem 3 is having constituted the drive mechanism which makes the impeller of the couple rotate and revolve around the sun by following (b) (**) and (**) about the embodiment 1 of the above-mentioned solving means 1.

(b) The carrier of the epicyclic-gear driving mechanism provided with the same planet gear of a couple was made to support both the impeller axis, enabling free rotation,
(**) Drive both impeller axis by the above-mentioned planet gear, respectively,
(**) A support component was made to support the above-mentioned carrier, enabling free rotation, and a center of rotation of the carrier concerned was coincided with the center of a mixing vessel positioned and fixed.

[0020]

[Function]

Since the center of rotation of the carrier of an epicyclic-gear driving mechanism is in agreement with the center of a mixing vessel, while two impellers serve as a pair and rotate at uniform velocity in the direction, along with the concentric circle to a mixing vessel, it revolves around the sun. Therefore, the fluid in a mixing vessel is uniformly agitated uniformly [the churning operation by the impeller of a couple] in the fluid in a mixing vessel.

[0021]

[Embodiment 1] (It corresponds to Claim 7)

The embodiment 1 is having made the carrier free and having used flywheel starter gear or a solar gear as the gear drive about the epicyclic-gear driving mechanism of the above-mentioned solving means 3.

[0022]

[Embodiment 2] (It corresponds to Claim 8)

The embodiment 2 is having used the carrier as the driving member and having used flywheel starter gear or a solar gear as the stationary gear about the epicyclic-gear driving mechanism of the above-mentioned solving means 3.

[0023]

[Embodiment 3] (It corresponds to Claim 9)

The embodiment 3 is having provided the non-circular recess in the buck upper surface, having carried out fitting of the lower end of an isomorphism-like mixing vessel to the non-circular recess concerned, and having fixed the mixing vessel to the above-mentioned buck about the positioning mechanism of the mixing vessel to the impeller in the above-mentioned solving means 3, enabling free attachment and detachment.

[0024]

[Function]

By fixing the means for supporting and the above-mentioned buck of an epicyclic-gear gearing, where the center of rotation of an epicyclic-gear gearing and the center of the non-circular recess on the upper surface of a buck are coincided. Since the center of the non-circular recess on the upper surface of a buck and the center of rotation of an epicyclic-gear gearing are in agreement, the center of rotation of an epicyclic-gear gearing and the center of a mixing vessel are always in agreement by carrying out fitting of the lower end of an isomorphism-like mixing vessel to the non-circular recess on the upper surface of a buck.

Therefore, attachment of the mixing vessel at the time of a maintenance can be made simply and easy.

[0025]

[Embodiment 4] (It corresponds to Claim 10)

The embodiment 4 is making an epicyclic-gear driving mechanism support by a guide support, enabling free rise and fall, and having been made to carry out a rise-and-fall drive according to a feed screw mechanism about the means for supporting of the epicyclic-gear driving mechanism in the above-mentioned embodiment 3.

[0026]

[Function]

By raising the above-mentioned base material by the above-mentioned feed screw mechanism, by

being able to pull up an impeller with an epicyclic-gear driving mechanism, and being able to take out from a mixing vessel to the upper part, and making it descend, an impeller can be depressed and it can insert in a mixing vessel from the upper part with an epicyclic-gear driving mechanism. Since between the detaching operation to the mixing vessel of this impeller is maintained by a guide support, as for the physical relationship of an impeller and a mixing vessel, it does not need to perform positioning of an impeller and a mixing vessel at the time of re mounting.

[0027]

[Solving means 4] (It corresponds to Claim 11)

Other means (solving means 4) provided in order to solve the aforementioned problem 3 are having constituted the drive mechanism of the agitating device by the above-mentioned solving means 2 by following (b) thru/or (**).

(b) The support component was made to support a gear drive movably, enabling free rotation, and was made to support the churning axis and intermediate shaft of a couple movably, enabling free rotation,

(**) Provide a rotating table with the gear in a (**) buck, and equip [driving the pinion of the churning axis of a couple, and the above-mentioned intermediate shaft by the above-mentioned gear drive,] it with a mixing vessel at the rotating table concerned, enabling free attachment and detachment,

(**) Drive the gear of a rotating table by the pinion of the above-mentioned intermediate shaft lower end.

[0028]

[Function]

The churning axis of a couple is driven at uniform velocity in the direction by the above-mentioned gear drive. On the other hand, since a rotating table is driven by the above-mentioned gear drive via an intermediate shaft, it is driven to a counter direction with a churning axis. Therefore, a mixing vessel drives to a counter direction with an impeller.

And since the viscous fluid in it circles to a counter direction with an impeller by rotation of a mixing vessel, a stirring effect and an agitating speed improve notably uniformly [the stirring effect by an impeller] to the viscous fluid in a mixing vessel.

[0029]

[Embodiment 1] (It corresponds to Claim 12)

The embodiment 1 is having made the infinite variable-speed drive placed between the above-mentioned intermediate shafts about the drive mechanism of the solving means 4.

[0030]

[Function]

Since the above-mentioned rotating table drives by the above-mentioned gear drive via the infinite variable-speed drive of an intermediate shaft, the revolving speed of a rotating table is stepless and is adjusted.

Since a churning operation of the agitating device by the solving means 4 is adjusted with the rotating velocity of an impeller, and the revolving speed of a mixing vessel, it can adjust a churning operation suitably according to the kind of fluid to be agitated, the churning purpose, churning lapsed time, etc. by adjusting the revolving speed of a rotating table with an infinite variable-speed drive. Since the hand of cut of a rotating table is reversed and the revolving speed can be adjusted if it is made the gearbox which can reverse the above-mentioned infinite variable-speed drive, it is still wide range and the strength of a churning operation can be adjusted with the roll control of a rotating table.

[0031]

[Embodiment of the Invention]

[Work example 1]

Sag of the two axes 2 and 2 is carried out by the wheel base L from the epicyclic-gear gearing, and

the impeller 1 is attached to the axes 2 and 2 of this couple, respectively. These impellers 1 and 1 are fields where that side is linear to a lengthwise direction. It is mutually turned in the right-angled direction, and the axes 2 and 2 rotate in the direction at uniform velocity.

The major axis 1a of the impeller 1 of this example is 71 mm, and the minor axis 1b is 35 mm. And although the curved surface shape of the side of an impeller can be chosen suitably, when both the impellers 1 and 1 rotate, in a total rotary place, the major-axis end of one impeller has a relation which touches the side of the impeller of another side mostly.

[0032]

Namely, when it is as an example of the form of the impeller 1 and the plane shape of the two impellers 1 and 1 being shown in drawing 14 (a) and two impellers in this thing have a right-angled relation mutually, When distance between the axes of rotation of two impellers is set to L, the curvature radius of the impeller side curved surface is set to R and the major-axis end circle radius of an impeller is set to alpha, It is $L=R+\alpha$, $R=L-\alpha$, and $\alpha=L-R$, and when distance of the center of the curvature radius R of the impeller side curved surface and an impeller shaft center is set to C, it can compute by $C=\sqrt{2(L/2-\alpha)}$. If the inside diameter of the mixing vessel at this time is set to D, it will be set to $D=2(C+\alpha)+L$, and that center will serve as the middle point between the two axes of rotation.

Drawing 14 (b) sets the wheel base L to 50, is an example when the major-axis end circle radius alpha is set to 3, and is set to $R=50-3=47$, $C=\sqrt{2(50/2-3)}=31.113$, and $D=2(31.113+3)+50=118.226$.

Drawing 14 (c) sets the wheel base L to 50, shows plane shape in case the major-axis end which set the major-axis end circle radius alpha to 0 is edge shape, and is set to $R=50-0=50$ in this case, $C=\sqrt{2(50/2-0)}=35.355$, and $D=2(35.355+0)+50=120.71$.

[0033]

Although the viscous fluid in the mixing vessel 3 is agitated by the impellers 1 and 1 of the above-mentioned couple, the inside diameter A of the mixing vessel 2 in this example is 124 mm, and the depth is 55 mm.

Relative rotating of the impeller of a couple is carried out in the direction in the mode of drawing 3 (a), (b), and (c). It slides so that the above-mentioned side may be ground, after the tip end part of one impeller 1 contacted mostly and has contacted in the lengthwise direction straight line to the side of the impeller 1 of another side at this time. Therefore, the flow of viscous fluid around which it takes and turns to the arrow direction of drawing 3 with one impeller will be severed by the impeller of another side, and will be pushed back in the direction contrary to the flow. The viscous fluid adhering to the flank part of the impeller of another side fails to be scratched by the point of one impeller. And the side which it fails to scratch of the two impellers so that change of drawing 3 (a), (b), and (c) may show, Since the side in which the side which fails to be scratched takes the place one by one by rotation, and one impeller fails to be scratched is also changed one by one by rotation of an impeller, the viscous fluid adhering to the both side surfaces of two impellers will fail to be scratched intermittently.

Since the major-axis end of the impeller 1 of this example slides on the inner surface of the mixing vessel 3 intermittently and the impellers 1 and 1 revolve around the sun within a mixing vessel, the viscous fluid adhering to the inner surface of the mixing vessel also fails to be intermittently scratched by the tip of an impeller.

[0034]

Only 50 cc (viscous degree 80 Pa-s), feed 100 cc (viscous degree 100 Pa-s) and the ink for lithography (yellow) into the mixing vessel 3, and the ink for lithography (cyanogen) under 25 ** temperature, By 76 rotating velocity/of an impeller, when [20 revolution speed] agitating by a part for /, as compared with the case (the conditions) where it is based on the conventional agitating

device, the churning time is mostly shortened to 1/10.

Although churning unevenness is not avoided in conventional technology, churning unevenness is completely solved in this example.

[0035]

Next, the rising and falling mechanism of the impeller drive by the epicyclic-gear gearing of this embodiment and an agitating device, etc. are explained.

Impeller drives are epicyclic-gear dynamo-electric means of the form which the flywheel starter gear 4 are being fixed to the support plate 14, and the carrier of a planet gear drives with an electric motor.

The support plate 14 is guided by the two guide supports 21 and 21, enabling free rise and fall. The vertical screw-thread axis 23 is among the guide supports 21 and 21, the lower end is supported by the buck 20 by a bearing, enabling free rotation, and the upper part is supported by the bearing by the side between the guide supports 21 and 21, enabling free rotation. And **** on the screw-thread axis 23, the sleeve 22 is made to have screwed, and this screw-thread sleeve 22 is being fixed to the support plate 14.

The flywheel starter gear 4 are being fixed to the undersurface of the support plate 14 with the screw 14a, and the upper bed of the cylindrical carrier 9 is supported by these flywheel starter gear 4 via the bearing 10.

The carrier 9 is held via the bearing 10 at the flywheel starter gear 4, enabling free rotation.

The two vertical axes 2 and 2 are supported by this carrier 9 via the bearings 8 and 8, enabling free rotation.

The driving shaft 15 was inserted in the center hole of the carrier 9, it has adhered, and the upper bed is connected with the axis of the electric motor 18 via the coupling 17, enabling free attachment and detachment.

[0036]

The planet gears 5 and 5 have adhered to the upper bed of the vertical axes 2 and 2, respectively, and these planet gears 5 and 5 have geared to the above-mentioned flywheel starter gear 4. The vertical axes 2 and 2 are caudad prolonged from the lower end of the carrier 9, and the lower end is inserted in the center hole of the above-mentioned impellers 1 and 1. In this example, the impeller electrode holder 7 has adhered to the upper bed side of the impeller 1, and this impeller electrode holder 7 has adhered to the vertical axes 2 and 2 by the pin, enabling free attachment and detachment.

As mentioned above, since the vertical axes 2 and 2 are held via the bearings 8 and 8 at the carrier 9, the carrier 9 is held via the bearing 10 at the flywheel starter gear 4, the flywheel starter gear 4 **** and it is being fixed to the support plate 14 by 14a, if the screw-thread axis 23 is rotated by the handle 24 and you make it go up and down the support plate 14, a drive will go up and down with this, and an impeller will go up and down. By raising an impeller, when the impeller 1 escapes to the upper part and drops it from the mixing vessel 3, the impeller 1 is inserted into the mixing vessel 3.

[0037]

The mixing vessel 3 is a cylindrical body, that lower end has the flange 3a, and the flat-surface part 3b of the couple which opposes this flange 3a is formed. On the other hand, the upper surface of the buck 20 has a crevice of form into which the flange 3a of the mixing vessel 3 gets densely, the above-mentioned flange will get into this crevice, and the mixing vessel 3 will be held at the buck 20 at rotation impossible.

[0038]

The driving shaft 15 drives via the coupling 17 with the axis of an electric motor, the carrier 9 drives by this, and the revolution drive of the vertical axes 2 and 2 is carried out by rotation of the carrier 9. Since the planet gear which has adhered to the upper bed of the vertical axes 2 and 2 has geared to the flywheel starter gear 4, while the vertical axes 2 and 2 rotate, it will revolve around the sun.

And the two above-mentioned planet gears are the same, and since it has geared to the same flywheel starter gear 4, the revolving speed of both the vertical axes 2 and 2 is equal, and revolves the same orbit top around the sun.

[0039]

[Work example 2]

Subsequently, the example of the agitating device by the solving means 2 is explained.

This Embodiment 2 does not have a difference in particular with the above-mentioned Embodiment 1 except for the point that the side of an impeller is a screw type-like side. The upper bed side of the impeller of this thing is in the position which shifted to the hand of cut 90 degrees to the lower end surface, and the side in the meantime and end rim are a screw type.

The plane shape of this thing and side form are as being shown in drawing 9 (a) and (b), and the section A-A in drawing 9 (b), B-B, C-C, D-D, and E-E are as being shown in drawing 10 (A) - (E), respectively.

All of such sectional shape are the same.

The elliptical (not the thing that says a strict ellipse but form which resembled the ellipse mostly) outline of the end face of the impeller 31 of this example, It is the form drawn by major axis of 71 mm, and 35 mm of minor axes with the common inscribed circle arc z and the partial circle of the above-mentioned imaginary circle x to the imaginary circle x with a radius of 4.77 mm of major-axis both ends, and the imaginary circle y with a main radius of 17.5 mm. The height of this impeller 31 is 50 mm. The overview of this thing is as being shown in drawing 11.

[0040]

By the same appearance as the case where two screws (screw-thread stick) gear mutually, the two impellers 31 and 31 are put together mutually, are arranged, and rotate at uniform velocity in the direction like Embodiment 1. A fluid is agitated at this time, the impeller 31 spiral-like side extruding at the method of the outside of a radial direction, and a slanting lower part (or slanting upper part). And since it exercises for a counter direction mutually while a major axis direction end spiral to one impeller slides on the spiral side of the impeller of another side mutually in the state where it contacted mostly, it is failed to scratch the viscous fluid adhering to the spiral side of the impeller of above-mentioned another side at the major axis direction end of above-mentioned one impeller. Since the impeller 31 extrudes in a direction with the velocity component of a turning direction, and the velocity component of the lengthwise direction strongly and a complicated flow is generated between the mixing vessel 3 and the impellers 31 and 31, the viscous fluid in the mixing vessel 3 has a very high stirring effect. Therefore, what is called a Weissenberg effect generated when the degree of viscosity mixes a greatly different substance (a unique flow phenomenon: if a stick is thrust in and stirred in a solution, an oil level will be cratered in a Newton liquid, but.) In a non-Newtonian liquid, the phenomenon which goes up by carrying out can be controlled so that it may rise conversely and may coil around a stick, and even when the degree of viscosity mixes a greatly different substance, churning and mixing are made very efficiently.

[0041]

As for the impellers 31 and 31 of the agitating device shown in drawing 7 and drawing 8, it is needless to say that it drives with the drive by the epicyclic-gear driving mechanism shown in drawing 4 thru/or drawing 6, both impellers are made to rotate and revolve around the sun, and the viscous fluid in the mixing vessel 3 can be agitated. However, as for the screw type-like two impellers 31 and 31, since the churning operation is powerful, a stirring effect is enough demonstrated only by rotation. Therefore, viscous fluid can fully be agitated only by rotation of the impellers 31 and 31 in a short time.

The churning drive only by rotation of the impellers 31 and 31 is shown in drawing 12. This thing is supported by the support plate 42 currently supported by the guide supports 41 and 41 enabling free rise and fall, enabling free rotation of the gear drive 43.

The vertical axis of the impellers 31 and 31 is supported enabling free rotation.

The pinion 44 has adhered to this vertical axis, respectively, and the pinion concerned has geared with the gear drive 43.

Since the pinion 44 will drive at uniform velocity in the direction if the driving shaft 45 of the gear drive 43 is driven with an electric motor, the impellers 31 and 31 drive at uniform velocity in the direction.

[0042]

The example of other drives is explained with reference to drawing 13. This drive also drives the mixing vessel 3 simultaneously with an impeller to the example of drawing 12 driving the impellers 31 and 31. In the pinion 44, the opposite hand is made to have supported the intermediate shaft 51, enabling the free rotation to the support plate 42, and the pinion 52 which adhered to the upper bed of this intermediate shaft is engaged to the gear drive 43. On the other hand, the buck 60 is made to have supported the rotating table 61, enabling free rotation, and this rotating table 61 is made to attach the mixing vessel 3 like Embodiment 1, enabling free attachment and detachment. And the gear 61a is formed in the peripheral face of the rotating table 61, and the pinion 53 which adhered to the gear 61a concerned in the lower end of the intermediate shaft 51 has geared.

Therefore, the rotating table 61 drives to the impeller 3 and a counter direction via the intermediate shaft 51 and the pinions 52 and 53 by the gear drive 43, therefore the mixing vessel 3 drives to the impeller 3 and a counter direction.

[0043]

Since high viscous fluid corotates to an arrow direction and the impeller 31 rotates to a counter direction with this by rotation of the mixing vessel 3, a stirring effect improves further. Since a stirring effect changes by adjusting revolving speed of an impeller, and revolving speed of the mixing vessel 3, A stirring effect can be minutely adjusted to the intermediate shaft 51 according to character of a fluid in the mixing vessel 3, and the churning purpose by making an easy infinite variable-speed drive by friction roller, a V belt, etc. intervene, and adjusting revolving speed of the mixing vessel 3 by this.

[0044]

[Translation done.]

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

- [Drawing 1]The top view of the important section of ***** 1.
- [Drawing 2]The perspective view of the important section of ***** 1.
- [Drawing 3]The top view showing the operating state of ***** 1.
- [Drawing 4]The important section top view of the impeller drive of ***** 1.
- [Drawing 5]Drawing of longitudinal section of ***** 1.
- [Drawing 6]Drawing of longitudinal section of the important section of the impeller drive of ***** 1.
- [Drawing 7]The top view of the important section of ***** 2.
- [Drawing 8]The perspective view of the important section of ***** 2.
- [Drawing 9](a) is a top view of the impeller of Embodiment 2, and (b) is a side view of the impeller.
- [Drawing 10](A) – (E) is a section A–A in Fig. 9 (b) – a sectional view of E–E.
- [Drawing 11]The whole impeller outline view of ***** 2.
- [Drawing 12]The perspective view of Embodiment 2 showing an example of a ***** drive.
- [Drawing 13]The perspective view of Embodiment 2 showing other examples of *****.
- [Drawing 14](a) and (b) are the top views for explaining an example of the plane shape of the impeller in an embodiment.
- (b) is a top view for explaining other examples of plane shape, and (c) is a top view for explaining the example of further others.

[Explanations of letters or numerals]

- 1: Impeller
- 2: Vertical axis
- 3: Mixing vessel
- 4: Flywheel starter gear
- 5: Planet gear
- 7: Impeller electrode holder
- 8: Bearing
- 9: Carrier
- 10: Bearing
- 14: Support plate
- 15: Driving shaft
- 17: Coupling
- 20: Buck
- 21: Guide support
- 23: Screw-thread axis
- 31: Impeller

41: Guide support
42: Support plate
43: Gear drive
44: Pinion
45: Driving shaft
51: Intermediate shaft
52, 53: Pinion
60: Buck
61: Rotating table
61a: Gear

[Translation done.]

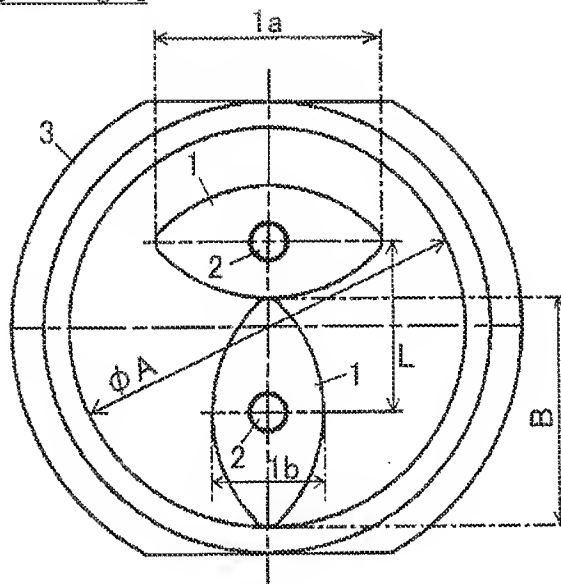
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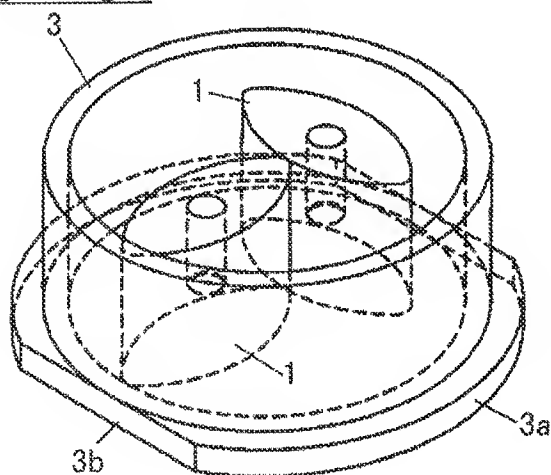
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DRAWINGS

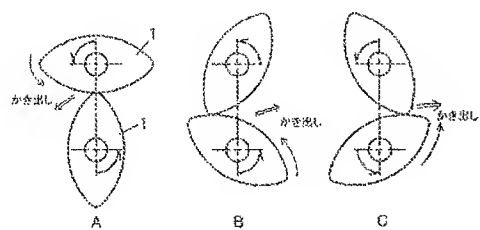
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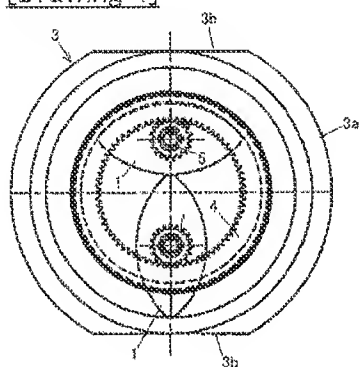
[Drawing 2]



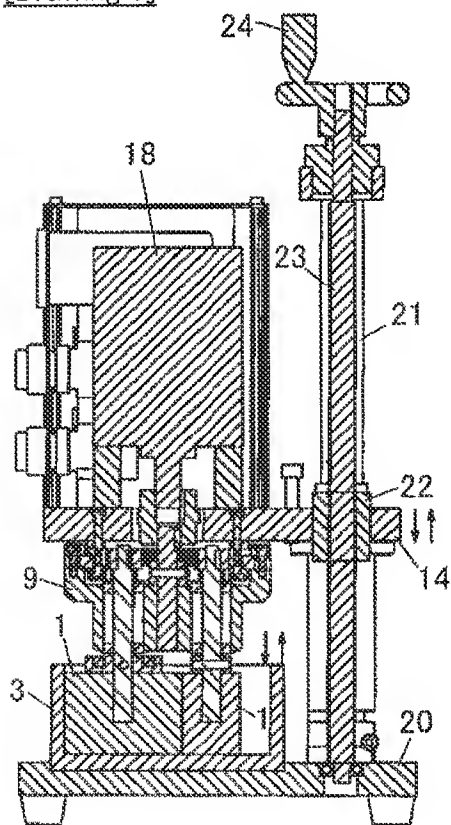
[Drawing 3]



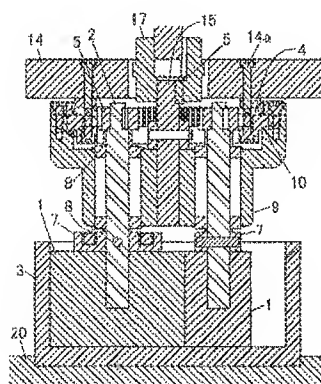
[Drawing 4]



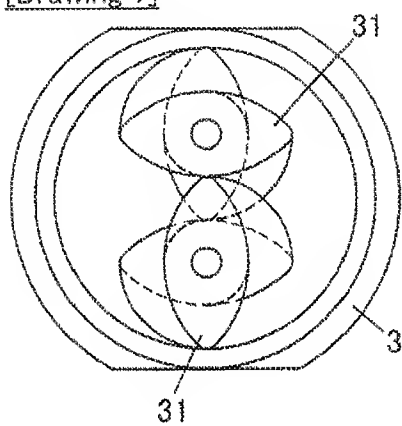
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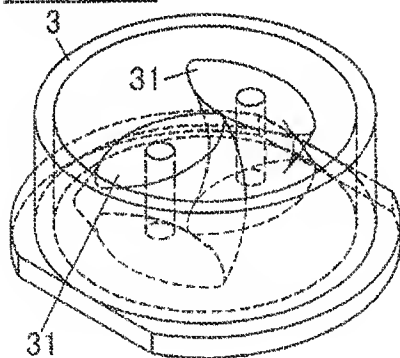
[Drawing 6]



[Drawing 7]

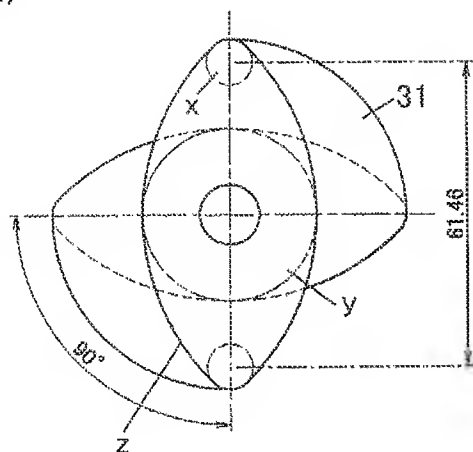


[Drawing 8]

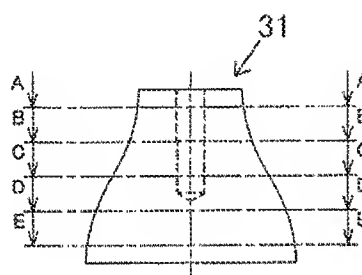


[Drawing 9]

(a)



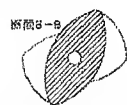
(b)

[Drawing 10]

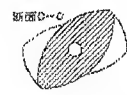
(A)



(B)



(C)

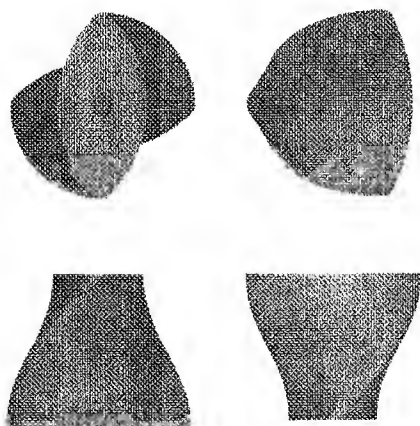


(D)

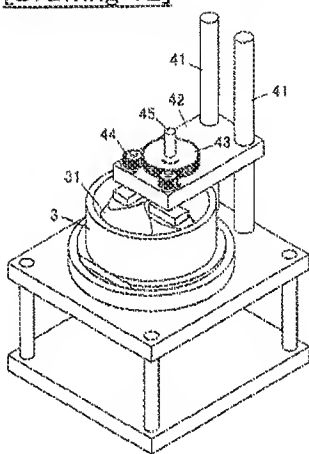


(E)

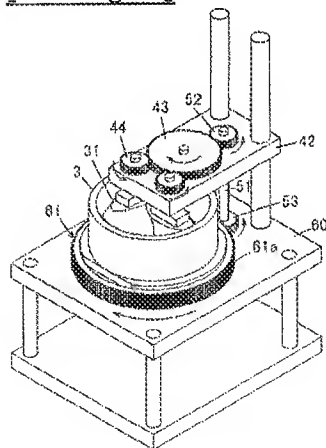
[Drawing 11]



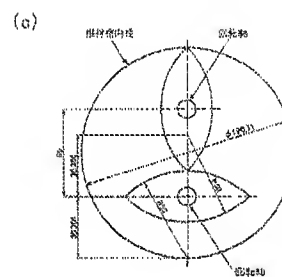
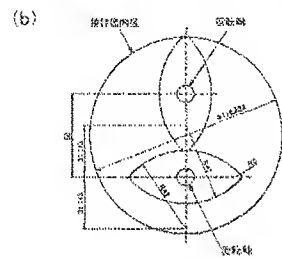
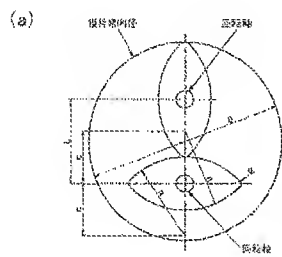
[Drawing 12]



[Drawing 13]



[Drawing 14]



[Translation done.]

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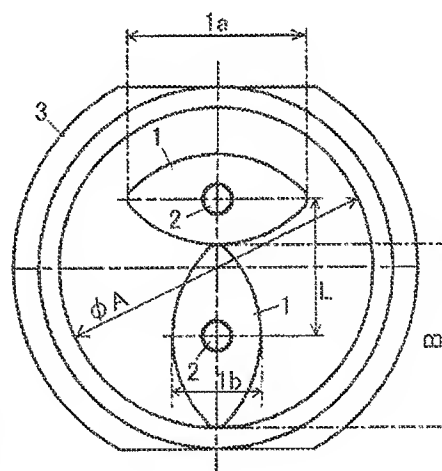
(54) 【発明の名称】 二軸攪拌装置

(57) 【要約】 (修正有)

【課題】二軸攪拌翼による高粘性流体の攪拌装置について、攪拌される流体の連れ回りを確実に防止し、かつ、攪拌翼表面に付着して攪拌されない部分が発生することを確実に防止できるような、一对の攪拌翼の形状を提供する。

【解決手段】一对の縦軸攪拌翼1を縦置き攪拌槽3内で自転させて、上記攪拌槽3内の高粘性流体を攪拌・混合する攪拌装置を前提として、攪拌翼1の水平断面が縦軸2を中心としたほぼ楕円形状であり、上記楕円形状の長径長さの1/2と短径長さの1/2の和が軸間距離に等しく、一方の攪拌翼1と他方の攪拌翼1の回転位相が90度ずれていて、等角速度で同方向に回転し、攪拌翼1の側曲面形状が、全回転位置において一方の攪拌翼1の先端部が他方の攪拌翼1の側面部分にほぼ接する形状であること。

【選択図】 図1



【特許請求の範囲】

【請求項1】

一対の縦軸攪拌翼を縦置き攪拌槽内で自転させて、上記攪拌槽内の高粘性流体を攪拌・混合する攪拌装置において、
攪拌翼の水平断面が縦軸を中心としたほぼ楕円形状であり、
上記楕円形状の長径長さの $1/2$ と短径長さの $1/2$ の和が軸間距離に等しく、
一方の攪拌翼と他方の攪拌翼の回転位相が90度ずれていて、同角速度で同方向に回転し、
攪拌翼の側曲面形状が、全回転位置において一方の攪拌翼の先端部が他方の攪拌翼の側面部分にほぼ接する形状である攪拌装置。

【請求項2】

二つの攪拌軸が自転とともに公転する請求項1の攪拌装置。

【請求項3】

上記攪拌翼の楕円形状の長径長さが軸間距離の $1/2$ よりも長く、軸間を結ぶ線上において縦攪拌槽に内接する長さにはほぼ等しい、請求項2の攪拌装置。

【請求項4】

上記攪拌翼の側面が縦方向に直線的な面である請求項1の攪拌装置。

【請求項5】

上記攪拌翼の側面が螺旋形状の面である請求項1の攪拌装置。

【請求項6】

上記一対の攪拌翼の自転・公転駆動機構が、1対の同一遊星ギヤを備えた遊星歯車伝動機構のキャリアに両攪拌翼軸を回転自在に支持させ、両攪拌翼軸を、上記遊星ギヤでそれぞれ駆動し、上記キャリアを回転自在に支持部材に支持させ、当該キャリアの回転中心を、位置決めされて固定された攪拌槽の中心に一致させたものである、請求項2の攪拌装置。

【請求項7】

上記遊星歯車伝動機構が、キャリアをフリーにし、リングギヤまたは太陽ギヤを駆動ギヤとしたものである、請求項6の攪拌装置。

【請求項8】

上記遊星歯車伝動機構が、キャリアを駆動部材とし、リングギヤまたは太陽ギヤを固定ギヤとしたものである、請求項6の攪拌装置。

【請求項9】

上記攪拌翼に対する攪拌槽の位置決め機構が、支持台上面に非円形凹部を設け、当該非円形凹部に同形状の攪拌槽の下端を嵌合させ、攪拌槽を支持台に着脱自在に固定したものである、請求項6の攪拌装置。

【請求項10】

上記遊星歯車伝動機構の支持装置が、遊星歯車伝動機構を案内支柱に昇降自在に支持させ、送りねじ機構によって昇降駆動するようにしたものである、請求項5の攪拌装置。

【請求項11】

支持部材に駆動ギヤを回転自在に支承させ、一対の攪拌軸及び中間軸を回転自在に支承させ、

上記駆動ギヤで一対の攪拌軸及び上記中間軸のピニオンを駆動し、
支持台に歯車付きの回転テーブルを設け、当該回転テーブルに攪拌槽を着脱自在に装着し、

回転テーブルの歯車を上記中間軸下端のピニオンで駆動する、請求項5の攪拌装置。

【請求項12】

上記中間軸に無段変速装置を介在させた請求項11の攪拌装置。

【発明の詳細な説明】

【0001】

【産業上の利用分野】

この発明は、比較的粘性度の高い流体を攪拌する攪拌装置に関するものであり、縦置き

円筒上の攪拌槽内の粘性流体を二つの攪拌翼で攪拌する攪拌装置について、攪拌槽の流体をむらなく均等に、能率的に攪拌・混合することができるものであり、比較的ゆっくりと攪拌翼を回転させながら、複数の高粘性流体を短時間で高精度かつ均等に混合することができるものである。

【0002】

【従来の技術】

高粘性流体に限らず様々な流体を縦置き円筒状攪拌槽に入れて、これを縦型の攪拌翼で攪拌する攪拌装置には様々な機構のものがある。その一つは一軸攪拌翼によるものであり、その一例が特開平8-71398号公報に記載されている。このような攪拌装置における攪拌翼の形状構造は、螺旋状の細板によるもの、平板状の縦板によるものなど様々であるが、上記公報に記載されているものは、縦方向攪拌機能と横方向攪拌機能とを共に有する板状攪拌翼を、回転方向に位相を順次ずらして多段に設けたものであり、これによって、上下方向の攪拌能率を高めて、高粘性流体の攪拌性能を向上させたものである。

また、二軸攪拌翼を備えたものとして、例えば、特開2002-113344号公報に記載されているものがあり、このものは、大小2つの螺旋状攪拌翼を自転させながら公転させることによって、攪拌効率を高めたものである。

【0003】

一軸攪拌翼によるもの、二軸攪拌翼によるもののいずれについても、個々の攪拌翼が個々に独立して攪拌槽内で自転し、あるいは自転・公転してこれを回転方向、あるいは回転方向及び縦方向に攪拌するものである。

攪拌装置における攪拌翼は、その表面が攪拌槽内の流体に対して回転するものであって、翼表面に接している流体に剪断力が作用するけれども、比較的粘性度が高い流体（以下これを「高粘性流体」という）の場合は、その粘着性のために攪拌翼表面から剥離せず、そのため引きずられ、この引きずり力が広範囲に及んで、周りの流体が連れ回される（共回りすることになる。また、攪拌翼表面に付着したままの層もある。このため、全体として攪拌・混合能率が極めて悪く、また、ほとんど攪拌・混合されない部分が残存し、その結果、攪拌・混合精度が悪く、仮に攪拌時間を長くしても均一に攪拌・混合することができない場合もある。

【0004】

【解決しようとする課題】

そこで、この発明は、二軸攪拌翼による高粘性流体の攪拌装置について、攪拌される流体の連れ回りを確実に防止し、かつ、攪拌翼表面に付着して攪拌されない部分が発生することを確実に防止できるように、一対の攪拌翼の形状を工夫することを、その課題1とするものである。

【0005】

さらに、一対の攪拌翼で攪拌槽内の流体に、旋回方向及び縦方向の一定の経路に沿った流れを強制して、攪拌槽内の流体に均等な攪拌作用が与えられる様に、一対の攪拌翼の形状を工夫することを、その課題2とするものである。

【0006】

さらに、一対の攪拌翼が、攪拌槽内の流体に均等に攪拌作用を及ぼす様に、その駆動機構を工夫することを、その課題3とするものである。

【0007】

【課題を解決しようとする手段】

【解決手段1】（請求項1に対応）

上記課題1を解決するために講じた手段（解決手段1）は、一対の縦軸攪拌翼を縦置き攪拌槽内で自転させて、上記攪拌槽内の高粘性流体を攪拌・混合する攪拌装置を前提として、次の（イ）乃至（ロ）によって構成されるものである。

（イ）攪拌翼の水平断面が縦軸を中心としたほぼ楕円形状であること、

（ロ）上記楕円形状の長径長さの $1/2$ と短径長さの $1/2$ の和が軸間距離に等しいこと

(ハ) 一方の攪拌翼と他方の攪拌翼の回転位相が90度ずれていて、等角速度で同方向に回転すること、

(ニ) 攪拌翼の側曲面形状が、全回転位置において一方の攪拌翼の先端部が他方の攪拌翼の側面部分にほぼ接する形状であること。

なお、上記の「ほぼ楕円形状」は、いわゆる楕円形状ではなく、長径と短径とを有する楕円に似た形状を意味する。

また、上記の「高粘性流体」は、攪拌翼に粘着して、攪拌翼の表面に粘着した流体層が形成される程度の粘性度を有する流体を意味する。

【0008】

【作用】

一对の攪拌翼が、その一方の先端部分が他方の側面にほぼ接した状態で同方向に回転するので、一方の攪拌翼の回転に連れて回る流れ（共回り）が、他方の攪拌翼によって遮断されるので、他方の攪拌翼の回転力の影響領域へ移り、その後、再び一方の攪拌翼の回転力の影響領域へ移動する。したがって、一つの攪拌翼の回転に引きずられて当該攪拌翼を中心とする旋回流が生じることはない。被攪拌流体は上記のような移動（流れ）を繰り返しながら攪拌槽の中で攪拌されることになる。

【0009】

また、一方の攪拌翼の側面に対して他方の攪拌翼の先端部分がほぼ接した状態で、互いに反対方向に回転するので、一方の攪拌翼の側面に付着した層が他方の攪拌翼によって掻き落とされて、上記他方の攪拌翼による攪拌領域へ押しやられる。そして、上記一方の攪拌翼の両側面のそれぞれに対する掻き落としは、1回転毎に1回の割合で繰り返される。したがって、攪拌翼の側面に一旦付着した流体もその直後に確実に攪拌されることになる。さらに、攪拌翼の断面形状の長径長さの $1/2$ と短径長さの $1/2$ の和が軸間距離にほぼ等しいので、攪拌槽の中心部分も攪拌翼の回転による攪拌領域内にあることになる。

【0010】

【実施態様1】（請求項2に対応）

実施態様1は、解決手段1の攪拌装置について、攪拌軸を自転とともに公転させることである。

【0011】

【作用】

一对の攪拌翼が攪拌槽内で自転しながら公転するので、攪拌槽内の流体全体に攪拌作用が均等に及び、また、個々の攪拌翼が定位置で自転する場合に比して、粘性流体が連れ回る傾向が小さいので、攪拌速度が一層向上する。

【0012】

【実施態様2】（請求項3に対応）

実施態様2は、上記実施態様1の攪拌翼について、その楕円形状の長径長さが軸間距離の $1/2$ よりも長く、軸間を結ぶ線上において縦攪拌槽に内接する長さにはほぼ等しいことである。

【0013】

【作用】

攪拌翼は公転しながら、その自転によって攪拌槽の内面に繰り返し接するので、攪拌槽の内面についても、付着した流体が攪拌翼の先端で掻き落とされて、攪拌翼による攪拌領域へ戻されるので、一旦攪拌槽の内面に付着した流体も確実に攪拌されることになる。したがって、攪拌槽の全ての部分が攪拌翼の自転・公転による攪拌領域になって均等に攪拌される。

【0014】

【実施態様3】（請求項4に対応）

実施態様3は、上記解決手段1における攪拌翼の側面を縦方向に直線的な面にしたことである。

【0015】

【作用】

攪拌翼の側面が縦方向に直線的な面であるから、粘性流体が攪拌翼の自転によって回転方向前方に押され、翼面にそって半径方向外方に押し出されながら攪拌される。このとき、一方の攪拌翼の先端部が他方の攪拌翼の側面に対して縦方向の直線に沿ってほぼ線接触した状態で、回転方向に摺動することになり、上記他方の攪拌翼の側面に付着している粘性流体を回転方向前方に向けて掻き出すことになる。

攪拌翼の側面が縦方向に直線的な面であるから、その形状は比較的単純であり、したがって、製作は比較的容易である。

【0016】

【解決手段2】（請求項5に対応）

上記課題2を解決するために講じた手段（解決手段2）は、上記解決手段1における攪拌翼の側面が螺旋形状の面であることである。

【0017】

【作用】

攪拌翼の側面が螺旋形状の面であるから、攪拌翼がスクリューとして機能し、粘性流体が攪拌翼の自転によって掻き回されるだけではなく、翼面にそって半径方向外方、及び斜め下方（回転方向によっては斜め上方）に押し出されながら攪拌される。このように、粘性流体が掻き回されながら積極的に上下方向に攪拌されるので、攪拌槽内に複雑な流れを生じ、これによって攪拌が促進される。

一方の攪拌翼の先端部は螺旋形状であって、他方の攪拌翼の螺旋状側面に対して縦方向の螺旋に沿ってほぼ線接触した状態で、螺旋方向に摺動することになり、上記他方の攪拌翼の側面に付着している粘性流体を回転方向前方かつ斜め下方に向けて掻き出すことになる。

【0018】

なお、上記螺旋形状の螺旋ピッチは任意であるが、螺旋ピッチが小さいほど流体を下方に押し出す作用が増大し、他方抵抗も増大する。他方、螺旋ピッチが小さいほど下方への押し出し速度が低下する。このピッチと攪拌翼の攪拌性能との関係は、攪拌翼の回転速度、攪拌される流体の粘性度などの物性にもよるので、最適ピッチは一概には決められない。したがって、必要な攪拌度合い、攪拌時間等に応じて、個々に最適の螺旋ピッチを選択する他はない。

【0019】

【解決手段3】（請求項6に対応）

上記課題3を解決するために講じた手段（解決手段3）は、上記解決手段1の実施態様1について、その一对の攪拌翼を自転及び公転させる駆動機構を、次の（イ）（ロ）及び（ハ）によって構成したことである。

（イ）一对の同一遊星ギヤを備えた遊星歯車伝動機構のキャリアに両攪拌翼軸を回転自在に支持させたこと、

（ロ）両攪拌翼軸を、上記遊星ギヤでそれぞれ駆動すること、

（ハ）上記キャリアを回転自在に支持部材に支持させ、当該キャリアの回転中心を、位置決めされて固定された攪拌槽の中心に一致させたこと。

【0020】

【作用】

遊星歯車伝動機構のキャリアの回転中心が攪拌槽の中心に一致しているので、二つの攪拌翼が対となって同方向に等速度で自転しながら、攪拌槽に対する同心円に沿って公転する。したがって、一对の攪拌翼による攪拌作用が攪拌槽内の流体に均等に及び、攪拌槽内の流体が均等に攪拌される。

【0021】

【実施態様1】（請求項7に対応）

実施態様1は、上記解決手段3の遊星歯車伝動機構について、キャリアをフリーにし、リングギヤまたは太陽ギヤを駆動ギヤとしたことである。

【0022】

【実施態様2】（請求項8に対応）

実施態様2は、上記解決手段3の遊星歯車伝動機構について、キャリアを駆動部材とし、リングギヤまたは太陽ギヤを固定ギヤとしたことである。

【0023】

【実施態様3】（請求項9に対応）

実施態様3は、上記解決手段3における攪拌翼に対する攪拌槽の位置決め機構について、支持台上面に非円形凹部を設け、当該非円形凹部に同形状の攪拌槽の下端を嵌合させ、攪拌槽を上記支持台に着脱自在に固定したことである。

【0024】

【作用】

遊星歯車伝動装置の回転中心と支持台上面の非円形凹部の中心とを一致させた状態で遊星歯車伝動装置の支持装置と上記支持台とを固定することで、支持台上面の非円形凹部の中心と遊星歯車伝動装置の回転中心とが一致しているので、支持台上面の非円形凹部に同形状の攪拌槽の下端を嵌合させることによって、遊星歯車伝動装置の回転中心と攪拌槽の中心とは常に一致する。

したがって、メンテナンス時の攪拌槽の組み付けを簡単、容易にすることができる。

【0025】

【実施態様4】（請求項10に対応）

実施態様4は、上記実施態様3における遊星歯車伝動機構の支持装置について、遊星歯車伝動機構を案内支柱によって昇降自在に支持させ、送りねじ機構によって昇降駆動するようにしたことである。

【0026】

【作用】

上記送りねじ機構で上記支持体を上昇させることによって、遊星歯車伝動機構とともに攪拌翼を引き上げて攪拌槽から上方に取り出すことができ、また下降させることによって、遊星歯車伝動機構とともに攪拌翼を押し下げて攪拌槽に上方から挿入することができる。この攪拌翼の攪拌槽に対する脱着操作の間も、攪拌翼と攪拌槽との位置関係は案内支柱によって維持されるから、再装着時に攪拌翼と攪拌槽の位置調整を行う必要はない。

【0027】

【解決手段4】（請求項11に対応）

上記課題3を解決するために講じた他の手段（解決手段4）は、上記解決手段2による攪拌装置の駆動機構を、次の（イ）乃至（ニ）によって構成したことである。

（イ）支持部材に駆動ギヤを回転自在に支承させ、一対の攪拌軸及び中間軸を回転自在に支承させたこと、

（ロ）上記駆動ギヤで一対の攪拌軸及び上記中間軸のピニオンを駆動すること、（ハ）支持台に歯車付きの回転テーブルを設け、当該回転テーブルに攪拌槽を着脱自在に装着すること、

（ニ）回転テーブルの歯車を上記中間軸下端のピニオンで駆動すること。

【0028】

【作用】

一対の攪拌軸は上記駆動ギヤによって同方向に等速度で駆動される。他方、回転テーブルは、中間軸を介して上記駆動ギヤで駆動されるから、攪拌軸とは反対方向に駆動される。したがって、攪拌槽が攪拌翼とは反対方向に駆動される。そして、攪拌槽の回転によってその中の粘性流体が攪拌翼とは反対方向に旋回するので、攪拌翼による攪拌効果が攪拌槽内の粘性流体に均等に及び、攪拌効果、攪拌速度が顕著に向上する。

【0029】

【実施態様1】（請求項12に対応）

実施態様1は、解決手段4の駆動機構について、上記中間軸に無段変速装置を介在させた

ことである。

【0030】

【作用】

上記回転テーブルが中間軸の無段変速装置を介して上記駆動ギヤで駆動されるので、回転テーブルの回転速度が無段階で調整される。

解決手段4による攪拌装置の攪拌作用は、攪拌翼の自転速度と攪拌槽の回転速度とによって加減されるから、無段変速装置で回転テーブルの回転速度を加減することによって、被攪拌流体の種類、攪拌目的、攪拌経過時間などに応じて、適宜攪拌作用を調整することができる。

また、上記無段変速装置を逆転可能な変速装置にすれば、回転テーブルの回転方向を逆転させ、かつその回転速度を加減できるので、回転テーブルの回転制御によって、攪拌作用の強弱をさらに広範囲で調整することができる。

【0031】

【実施の形態】

【実施例1】

遊星歯車伝動装置から軸間距離 L で2つの軸2、2が垂下されており、この一対の軸2、2に攪拌翼1がそれぞれ取り付けられている。この攪拌翼1、1は、その側面が縦方向に直線的な面であり、互いに直角の方向に向けられていて、軸2、2が等速度で同方向に回転する。

この例の攪拌翼1の長径 $1a$ は71mm、短径 $1b$ は35mmである。そして、攪拌翼の側面の曲面形状は適宜選択できるが、両攪拌翼1、1が回転するとき、全回転位置において一方の攪拌翼の長径端部が他方の攪拌翼の側面にほぼ接する関係にあるものである。

【0032】

すなわち、攪拌翼1の形状と、2つの攪拌翼1、1の平面形状の一例を図14(a)に示すとおりであり、このものにおける2つの攪拌翼が互いに直角の関係にあるときに、2つの攪拌翼の回転軸間距離を L とし、攪拌翼側曲面の曲率半径を R とし、攪拌翼の長径端部円弧半径を α としたとき、 $L=R+\alpha$ 、 $R=L-\alpha$ 、 $\alpha=L-R$ であり、攪拌翼側曲面の曲率半径 R の中心と攪拌翼回転軸中心の距離を C としたとき、 $C=\sqrt{2(L/2-\alpha)}$ で算出することができる。また、この時の攪拌槽の内径を D とすると、 $D=2(C+\alpha)+L$ となり、その中心は2つの回転軸間の中点となる。

図14(b)は軸間距離 L を50とし、長径端部円弧半径 α を3としたときの例であり、 $R=50-3=47$ 、 $C=\sqrt{2(50/2-3)}=31.113$ 、 $D=2(31.113+3)+50=118.226$ となる。

図14(c)は軸間距離 L を50とし、長径端部円弧半径 α を0とした長径端部がエッジ状の場合の平面形状を示すものであり、この場合の $R=50-0=50$ 、 $C=\sqrt{2(50/2-0)}=35.355$ 、 $D=2(35.355+0)+50=120.71$ となる。

【0033】

上記一対の攪拌翼1、1で攪拌槽3の中の粘性流体を攪拌するのであるが、この例における攪拌槽2の内径 A は124mmであり、深さは55mmである。

一対の攪拌翼は、図3(a)(b)(c)の態様で同方向に相対回転する。このとき一方の攪拌翼1の先端部分が他方の攪拌翼1の側面に対して縦方向直線でほぼ接触し、接触した状態で上記側面を擦るように撹動する。したがって、一方の攪拌翼とともに図3の矢印方向に連れ回る粘性流体の流れは、他方の攪拌翼によって断たれ、また、その流れと逆の方向に押し返されることになる。また、他方の攪拌翼の側面部分に付着している粘性流体が一方の攪拌翼の先端部で掻き落とされる。そして、図3(a)(b)(c)の変化から解るように、二つの攪拌翼のうちの掻き落とす側と、掻き落とされる側とが回転によって順次交替し、また、一つの攪拌翼の掻き落とされる側面も攪拌翼の回転によって順次交替するので、二つの攪拌翼の両側面に付着する粘性流体は間欠的に掻き落とされることになる。

この例の攪拌翼1の長径端部が攪拌槽3の内面に間欠的に撹動し、かつ攪拌翼1、1は攪

拌槽内で公転するので、攪拌槽の内面に付着した粘性流体も攪拌翼の先端によって間欠的に掻き落とされる。

【0034】

平版印刷用インク（シアン）を100cc（粘性度100Pa・s）、平版印刷用インク（イエロー）を50cc（粘性度80Pa・s）だけ攪拌槽3に投入して、温度25℃の下で、攪拌翼の自転速度76回/分、公転速度20回/分で攪拌するとき、従来の攪拌装置による場合（同条件）に比して、その攪拌時間がほぼ1/10に短縮される。また、従来技術では攪拌むらが避けられないが、この例では、攪拌むらが全く解消する。

【0035】

次に、この実施例の遊星歯車伝動装置による攪拌翼駆動装置、及び攪拌装置の昇降機構などについて説明する。

攪拌翼駆動装置は、リングギヤ4が支持板14に固定されていて、遊星ギヤのキャリアが電動モータで駆動される形式の遊星歯車電動装置である。

支持板14は2つの案内支柱21、21で昇降自在に案内されている。案内支柱21、21の間に縦のねじ軸23があって、その下端が支持台20にベアリングによって回転自在に支持され、上部が案内支柱21、21間の横板に軸受によって回転自在に支持されている。そしてねじ軸23にねじスリーブ22を螺合させてあり、このねじスリーブ22が支持板14に固定されている。

支持板14の下面にリングギヤ4がネジ14aで固定されており、このリングギヤ4に円筒状のキャリア9の上端が、ベアリング10を介して支持されている。

キャリア9は、ベアリング10を介してリングギヤ4に回転自在に保持されており、このキャリア9に2つの縦軸2、2がベアリング8、8を介して回転自在に支持されている。

キャリア9の中心穴に駆動軸15が挿入されて固着されており、その上端がカップリング17を介して、電動モータ18の軸に着脱自在に連結されている。

【0036】

縦軸2、2の上端に遊星ギヤ5、5がそれぞれ固着されており、この遊星ギヤ5、5が上記リングギヤ4に噛み合っている。また、縦軸2、2はキャリア9の下端から下方に延びていて、その下端が上記攪拌翼1、1の中心穴に嵌め込まれている。この例では攪拌翼1の上端面に攪拌翼ホルダー7が固着されていて、この攪拌翼ホルダー7がピンによって縦軸2、2に着脱自在に固着されている。

上記のように、縦軸2、2はベアリング8、8を介してキャリア9に保持されており、キャリア9がベアリング10を介してリングギヤ4に保持され、リングギヤ4がねじ14aによって支持板14に固定されているので、ねじ軸23をハンドル24で回転させて支持板14を昇降させると、これとともに駆動装置が昇降し、また、攪拌翼が昇降する。攪拌翼を上昇させることによって攪拌翼1が攪拌槽3から上方に脱出し、下降させることによって攪拌翼1が攪拌槽3内に挿入される。

【0037】

攪拌槽3は円筒体であり、その下端にフランジ3aがあって、このフランジ3aに対抗する一对の平面部3bが設けられている。他方、支持台20の上面に攪拌槽3のフランジ3aが密に嵌まり込む形状の凹部があり、この凹部に上記フランジが嵌まり込んで、攪拌槽3が回転不能に支持台20に保持されることになる。

【0038】

電動モータの軸によってカップリング17を介して駆動軸15が駆動され、これによってキャリア9が駆動され、キャリア9の回転によって縦軸2、2が公転駆動される。縦軸2、2の上端に固着されている遊星ギヤが、リングギヤ4に噛み合っているので、縦軸2、2が自転しながら公転することになる。

そして、上記二つの遊星ギヤが同じものであり、同じリングギヤ4に噛み合っているので、両縦軸2、2の回転速度は等しく、同じ軌道上を公転する。

【0039】

【実施例2】

次いで、解決手段2による攪拌装置の例について説明する。

この実施例2は攪拌翼の側面が螺旋形状の面である点を除き、上記実施例1と特に違いはない。このものの攪拌翼の上端面は下端面に対して90度回転方向にずれた位置にあり、その間の側面及び端縁は螺旋形である。

このものの平面形状、側面形状は図9(a)(b)に示すとおりであり、図9(b)における断面A-A、B-B、C-C、D-D、E-Eは、図10(A)～(E)にそれぞれ示すとおりであり、これらの断面形状は全て同じである。

この例の攪拌翼31の端面の楕円形状(厳密な楕円をいうものではなく、ほぼ楕円に似た形状)の概略は、長径71mm、短径35mmで、長径両端の半径4.77mmの仮想円xと中心の半径17.5mmの仮想円yに対する共通内接円弧zと、上記仮想円xの一部円弧とで描かれる形状である。また、この攪拌翼31の高さは50mmである。このものの全体像は図11に示すとおりである。

【0040】

2つの攪拌翼31、31は2つのスクリュー(ねじ棒)が互いにかみ合う場合と同様の格好で互いに合わされて配置され、実施例1と同様に、同方向に等速度で回転する。このとき、流体は攪拌翼31螺旋状の側面によって半径方向外方及び斜め下方(又は斜め上方)に押し出されながら攪拌される。そして、一方の攪拌翼に螺旋状の長径方向端部が他方の攪拌翼の螺旋状側面にほぼ当接した状態で互いに滑り合いながら、互いに反対方向に運動するので、上記他方の攪拌翼の螺旋側面に付着した粘性流体を上記一方の攪拌翼の長径方向端部で掻き落とす。

攪拌槽3内の粘性流体は攪拌翼31によって、旋回方向の速度成分と縦方向の速度成分をもった方向に強く押し出されて、攪拌槽3と攪拌翼31、31との間に複雑な流れが生成されるので、攪拌効果が極めて高い。したがって、粘性度が大きく異なる物質を混合するときに発生する、いわゆるワイゼンベルグ効果(特異な流動現象:溶液中に棒を突っ込んで掻き回すと、ニュートン液体では液面がへこんでしまうが、非ニュートン液体では逆に盛り上がりてきて棒に巻き付くように上っていく現象)を抑制することができ、粘性度が大きく異なる物質を混合する場合でも極めて能率的に攪拌・混合がなされる。

【0041】

図7、図8に示す攪拌装置の攪拌翼31、31は、図4乃至図6に示す遊星歯車伝動機構による駆動装置で駆動して、両攪拌翼を自転・公転させて、攪拌槽3内の粘性流体を攪拌できるのは勿論である。しかし、螺旋形状の二つの攪拌翼31、31は、その攪拌作用が強力であるので、自転のみで攪拌効果が十分発揮される。したがって、攪拌翼31、31の自転のみで粘性流体を短時間で十分に攪拌することができる。

攪拌翼31、31の自転のみによる攪拌駆動装置を図12に示している。このものは、案内支柱41、41に昇降自在に支持されている支持板42に駆動ギヤ43が回転自在に支持されており、また攪拌翼31、31の縦軸が回転自在に支持されている。この縦軸にそれぞれピニオン44が固着されていて、当該ピニオンが駆動ギヤ43と噛み合っている。駆動ギヤ43の駆動軸45を電動モータで駆動すると、ピニオン44が同方向に等速度で駆動されるので、攪拌翼31、31が同方向に等速度で駆動される。

【0042】

図13を参照して他の駆動装置の例を説明する。この駆動装置は図12の例が攪拌翼31、31を駆動するのに対して、攪拌翼と共に攪拌槽3をも同時に駆動するものである。ピニオン44とは反対側に中間軸51を支持板42に回転自在に支持させてあって、この中間軸の上端に固着したピニオン52を駆動ギヤ43に噛み合わせている。他方、支持台60に回転テーブル61を回転自在に支持させてあり、この回転テーブル61に攪拌槽3を実施例1と同様に着脱自在に嵌着させている。そして回転テーブル61の外周面にギヤ61aを設けてあり、当該ギヤ61aに中間軸51の下端に固着したピニオン53が噛み合っている。

したがって、駆動ギヤ43によって中間軸51、ピニオン52、53を介して、回転テーブル61が、攪拌翼3と反対方向に駆動され、したがって、攪拌翼3と反対方向に攪拌槽

3が駆動される。

【0043】

攪拌槽3の回転によって高粘性流体が矢印方向に共回りし、これとは反対方向に攪拌翼31が自転するので、攪拌効果が一層向上する。攪拌翼の回転速度と攪拌槽3の回転速度とを調整することによって攪拌効果が変化するから、中間軸51に、摩擦ローラ、Vベルトなどによる簡単な無段変速装置を介在させ、これによって攪拌槽3の回転速度を加減することによって、攪拌効果を攪拌槽3内の流体の性質、攪拌目的に応じて、微細に調整することができる。

【0044】

【発明の効果】

この発明の効果を整理すれば次のとおりである。

1. 第1番目の発明の効果

解決手段1による発明(請求項1に係る発明)は、一对の攪拌翼が同方向に回転し、一方の攪拌翼の長径端部が他方の攪拌翼の側面にほぼ当接した状態でこすり合いながら回転することによって、個々の攪拌翼の回転に連れて共回りする流体の流れを他方の攪拌翼によって遮断して、共回りを阻止し、当該共回り方向とは反対の方向に押し返すものである。このようにして押し返された流体は上記他方の攪拌翼の攪拌領域へ移動して、これによって攪拌される。また、上記他方の攪拌翼の側面に付着した流体の層を上記一方の攪拌翼の長径端部で掻き落とされて、一方の攪拌翼の攪拌領域へ誘導され、これによって攪拌される。

したがって、攪拌槽内の流体はまんべんなく均等に攪拌される。

【0045】

2. 第2番目の発明の効果

解決手段2による発明(請求項5に係る発明)は、攪拌翼の側面が螺旋面であって、一对の攪拌翼が同方向に回転し、一方の攪拌翼の長径端部が他方の攪拌翼の側面にほぼ当接した状態でこすり合いながら回転することによって、個々の攪拌翼の回転に連れて共回りする流体の流れを他方の攪拌翼によって遮断して、共回りを阻止し、当該共回り方向とは反対の方向に押し返すものである。

水平断面形状がほぼ楕円形状であって、その側面が螺旋形であるから、その自転によって、流体の下方(回転方向によっては上方)に強く押し出されるので、粘性流体に上下方向の強い流れを生じる。

自転に伴う攪拌と、上下方向の流れによる攪拌とによって、粘性流体が方向を変えながら複雑な経路で流れるので、攪拌が一層促進される。

【0046】

3. 第3番目の発明の効果

解決手段3による発明(請求項6に係る発明)は、一对の攪拌翼を遊星歯車伝導装置によって駆動して、これを自転・公転させるものであるから、簡単な駆動機構によって一对の攪拌翼を等速度で回転させ、かつ同軌道上で公転させることができる。したがって、駆動機構の製造コストを低減でき、また、駆動装置の小型軽量化が図られる。

【0047】

4. 第4番目の発明の効果

解決手段4による発明(請求項11に係る発明)は、攪拌翼を自転させるとともに攪拌槽を回転させるものであるから、攪拌翼の自転だけで攪拌効果を生じさせるものに比して、著しく攪拌効果が高く、攪拌槽の回転駆動機構を極めて単純であるから、自転・公転させる形式のものにして攪拌性能は格別違わないが、駆動装置を著しく単純にすることができる。

また、攪拌翼の回転速度を一定にしたままで、攪拌槽の回転速度を調整することによって攪拌性能を適宜調整することができる。

【図面の簡単な説明】

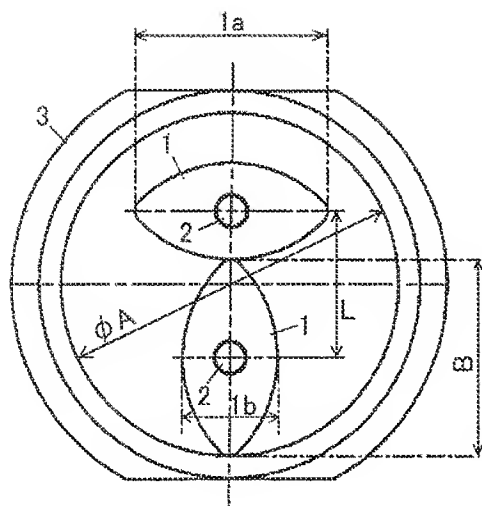
【図1】は実施例1の要部の平面図。

【図2】は実施例1の要部の斜視図。
【図3】は実施例1の動作状態を示す平面図。
【図4】は実施例1の攪拌翼駆動装置の要部平面図。
【図5】は実施例1の縦断面図。
【図6】は実施例1の攪拌翼駆動装置の要部の縦断面図。
【図7】は実施例2の要部の平面図。
【図8】は実施例2の要部の斜視図。
【図9】(a)は実施例2の攪拌翼の平面図、(b)は同攪拌翼の側面図。
【図10】(A)～(E)は、第9図(b)における断面A―A～E―Eの断面図。
【図11】は実施例2の攪拌翼の全体外観図。
【図12】は攪拌駆動装置の一例を示す実施例2の斜視図。
【図13】は攪拌装置の他の例を示す実施例2の斜視図。
【図14】(a)(b)は、実施例における攪拌翼の平面形状の一例を説明するための平面図であり、(b)は平面形状の他の例を説明するための平面図であり、(c)はさらに他の例を説明するための平面図である。

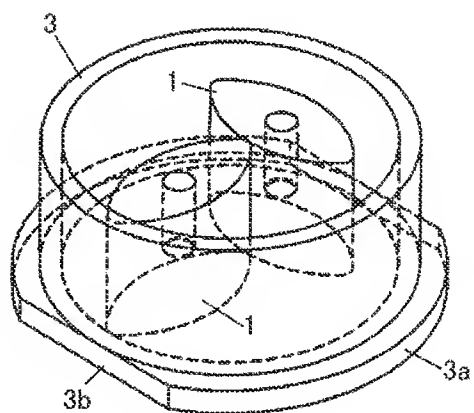
【符号の説明】

1：攪拌翼
2：縦軸
3：攪拌槽
4：リングギヤ
5：遊星ギヤ
7：攪拌翼ホルダー
8：ベアリング
9：キャリヤ
10：ベアリング
14：支持板
15：駆動軸
17：カップリング
20：支持台
21：案内支柱
23：ねじ軸
31：攪拌翼
41：案内支柱
42：支持板
43：駆動ギヤ
44：ピニオン
45：駆動軸
51：中間軸
52、53：ピニオン
60：支持台
61：回転テーブル
61a：ギヤ

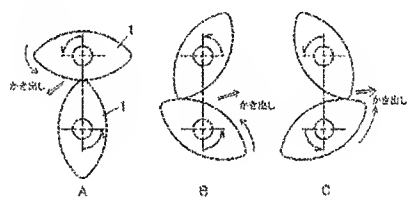
【図1】



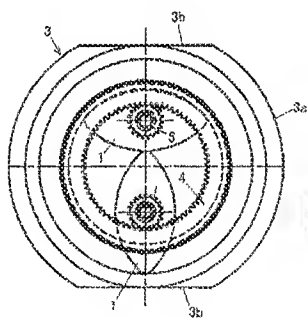
【図2】



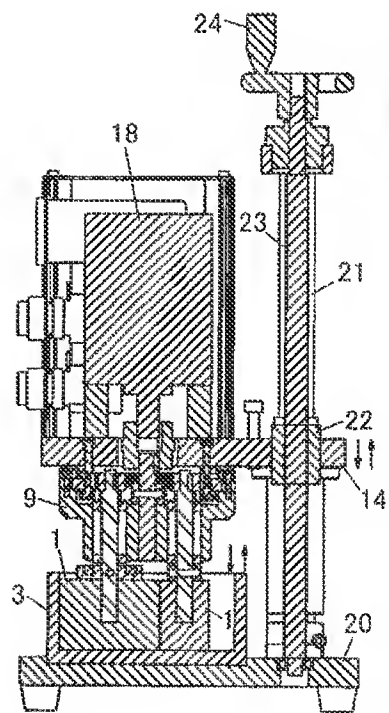
【図3】



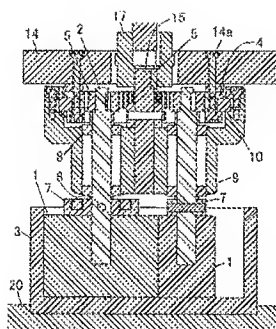
【図4】



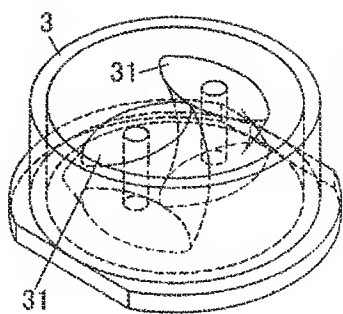
【図5】



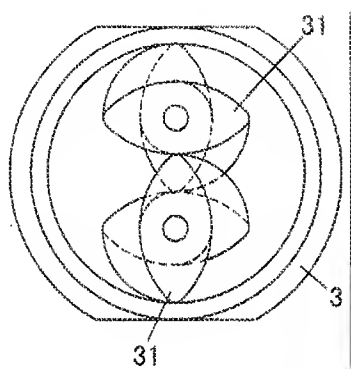
【図6】



【図8】

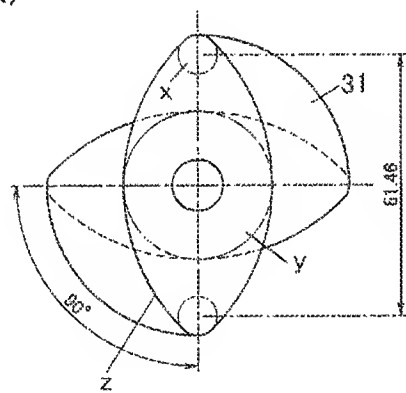


【図7】

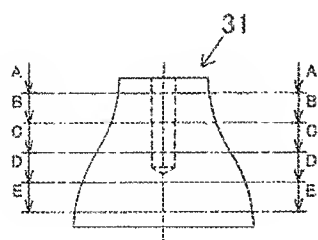


【図9】

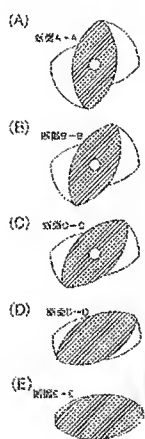
(a)



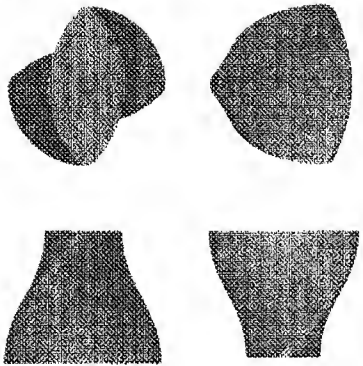
(b)



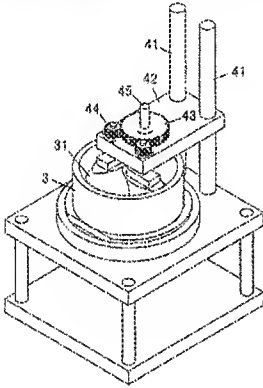
【図10】



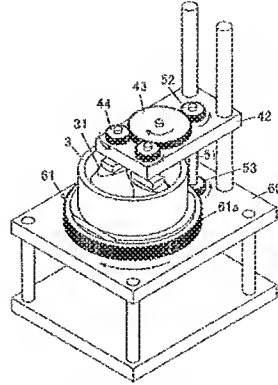
【図11】



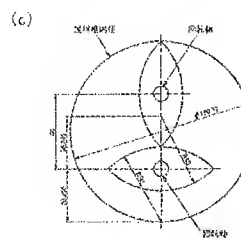
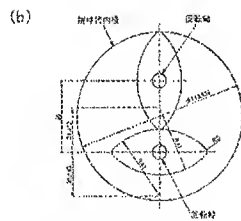
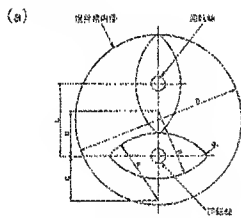
【図12】



【図13】



【図14】



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